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Insect Pests.—*Agric. Gaz. N.S.W.* **53** pt. 6 pp. 285–287, 2 figs. Sydney, 1942.

This part of a series on insect pests in New South Wales [*cf. R.A.E.*, A **31** 87] contains brief notes on the life-history and control of *Penthaleus major*, Dugès, the preferred food-plants of which are lettuce, peas, lucerne, subterranean clover and a number of pasture weeds, although it also attacks various garden flowers and vegetables, including turnip, rape, spinach and beet [*cf.* **29** 236], and of the more important pests of carrot. *Listroderes obliquus*, Gylh. [*cf.* **30** 156] can be controlled on carrot with lead arsenate as a spray (4 oz. in 5 gals. water) or dust (1 lb. with 4 lb. kaolin or hydrated lime). All weeds should be destroyed early in the winter, and the ground should be baited after a few days with poisoned foliage or a mash containing 24 lb. bran, ½ lb. sodium arsenite or 1 lb. Paris green and 2½ gals. water, with the addition of 8 oz. salt in place of molasses, which is now unobtainable. Infestation by the carrot Aphid, *Cavariella* sp., which feeds mainly on the undersides of the leaves and may cause them to curl and dry up, is sometimes severe; it may be controlled with a spray of 1 fl. oz. nicotine sulphate, 2 oz. soap and 4 gals. water or a dust of nicotine sulphate in hydrated lime (1 : 16). Jassids should be controlled with a spray of nicotine sulphate and Bordeaux mixture (1 : 1 : 20), which is also effective against the Aphid.

HELSON (G. A. H.). **The Leaf Hopper** *Thamnotettix argentata* **Evans, a Vector of Tobacco Yellow Dwarf.**—*J. Coun. sci. industr. Res. Aust.* **15** no. 2 pp. 175–184, 4 figs., 3 refs. Melbourne, 1942.

Investigations on the bionomics of *Thamnotettix argentata*, Evans, which transmits the virus causing tobacco yellow dwarf in Australia [*cf. R.A.E.*, A **30** 279], were carried out from October 1940 to December 1941. This Jassid has been found in southern Queensland and Western Australia, as well as in many districts of New South Wales and Victoria, where the disease is most prevalent. Lists are given of plants (chiefly weeds of various families) on which it bred throughout the year, from autumn to spring or in summer, of plants on which nymphs hatched but failed to develop, and of those on which only adults were found. Field observations in Victoria showed that it bred on capeweed (*Cryptostemma calendulaceum*) and crowfoot (*Erodium cicutarium*) and increased to considerable numbers before these weeds died at the end of November, when adults of the first generation, which had reached a peak of abundance and were apparently carrying the virus, migrated to young tobacco plants, for lack of other food [*cf.* **30** 280]. These adults returned to young weed seedlings to oviposit almost as soon as they appeared above the ground in summer; adults of the second generation were numerous at the end of February and nymphs of the third and overwintering generation in mid-March. Observations indicated that the winter is passed in the adult stage at Canberra, where the weather is cold, and in the adult and late nymphal stages in warmer districts such as northern Victoria. The adults seldom fly during the day, but mass flights were observed round lights on nights that followed hot days in summer.

In the laboratory during October–March, oviposition began 3–7 days after emergence and each female laid an average of 6 eggs per day for several months. The eggs were laid singly in incisions in the stem, petiole or main-rib. The nymphs hatched in 7–22 days and passed through five instars, each of which averaged five days in length. Both nymphs and adults fed on the lower surface of the leaf or on young petioles. A male and female that emerged in late February lived 125 and 240 days, respectively; the female laid fertile eggs until the end of May and again from the end of August until just before it died, although it had not mated after June. Calculations based on a study of the life-cycle at 15·6, 22, 28 and 34°C. [60, 71·6, 82·4 and 93·2°F.] showed that the thresholds of development for eggs, feeding stages and total life-cycle were 13·7, 12·8 and 14·4°C. [56·7, 55 and 57·9°F.].

SMITH (A. J.) & WHITNALL (A. B. M.). **The Concentration and Distribution of HCN in Relation to Vine Fumigation.**—*Sci. Bull.* [*Dep. Agric. For.*] *S. Afr.* no. 158, 14 pp., 5 figs., 10 refs. Pretoria [1942].

Mealybugs are serious pests of grape-vines in South Africa, but have been effectively controlled by fumigation with hydrocyanic acid gas in winter. Success in treatment depends on the use of impermeable tents and the fact that the dormant vines can withstand a very heavy dose of the gas. If the tents are practically gas-tight, the use of a dosage based purely on cubic capacity appears to be justifiable. Information on the technique of vine fumigation is lacking, however, and experiments were therefore carried out with a gas-proof cover over a form or trellis, 45 ins. high, 22 ins. wide and 89 ft. long, to determine the concentration and distribution of gas obtained when liquid hydrocyanic acid was atomised at the rate of 18 cc. per 100 cu. ft. of space at a single point or at two, three or six points at equal distances along the tent. Analysis of samples taken 5, 10, 15, 20, 30 and 45 minutes later showed that the lowest mean concentration was obtained when the fumigant was applied at one point and the highest when it was evenly distributed between six points, and the initial gas distribution was most erratic when it was applied at only one point, but the difference was comparatively small, and it does not appear necessary to use more than three application points. Wind, at velocities up to 8·3 miles per hour, appeared to have very little effect on gas leakage when the edge of the cover was well sealed with soil, but caused considerable loss if it lifted the edge. Very high temperatures, sometimes 44°F. higher than those outside, were recorded inside the covers, and these would tend to increase the efficiency of fumigation by making the gas, and probably also the insects, more active. A high concentration of gas was maintained throughout the exposure in all the experiments, whereas the loss of gas was rapid in comparative tests with a 10 oz. citrus-fumigation cover over a tree form. With the dosage applied at one point in two experiments, the average mean concentration after 30 minutes amounted to 48·4 per cent. of the theoretical concentration with the gas-tight cover and only 11·9 per cent. with the 10 oz. cover, in spite of the relatively larger volume and smaller surface area in the case of the latter. Although the lethal dose for the mealybugs and their eggs has not been determined, the high concentrations obtained indicate that the dosage used would give adequate control in 45 minutes; if it did not, the effect of prolonging the exposure should be tested, to avoid the cost of increasing the amount of fumigant applied.

BEIRNE (B. P.). **Observations on the Developmental Stages of some Aphidiinae (Hym., Braconidae).**—*Ent. mon. Mag.* **78** no. 943 pp. 283–286, 4 figs., 3 refs. London, 1942.

Three Aphidiine Braconids, all of which pupated within the skin of the host, were bred in Ireland from *Anuraphis roseus*, Baker, a very common pest of apple. The most abundant was a species of *Aphidius*, apparently *A. matricariae*, Hal.; *A. avenae*, Hal., was uncommon, and only a single individual of *Ephedrus pulchellus*, Stelfox, was obtained. Characters are given by which first-instar larvae of *A. matricariae* may be distinguished from those of *Praon volucre*, Hal. [*cf. R.A.E.*, A **31** 48] and of *Aphidius ulmi*, Marsh., which was the most numerous parasite of a common Aphid on knapweed [*Centaurea*], thought to be *Anuraphis padi*, L. (*helichrysi*, Kalt.) var. *centauriella*, Theo. *P. volucre*, *Trioxys centaureae*, Hal., and an undetermined species, probably of the genus *Aphidius*, were also found attacking the knapweed aphis. The immature stages of *Praon*, *Trioxys* and the species of *Aphidius* are compared, and characters of the first-instar larvae that are probably typical of the genus *Aphidius* are listed.

PEARMAN (J. V.). **Third Note on Psocoptera from Warehouses.**—*Ent. mon. Mag.* **78** no. 943 pp. 289–292, 3 figs. London, 1942.

Two further species of Psocoptera taken in warehouses in England [*cf. R.A.E.*, A **19** 721] are *Lepinotus reticulatus*, End., which was found in a London granary in 1940, and *Leposcelis paetus*, sp. n., which is described from adults of both sexes found among wheat, barley and maize in granaries and a ship's hold in London, Liverpool, Bideford and Truro in 1940–42, and in linseed oil-cake dust in Calcutta in 1937.

Chaetopsocus richardsi, Pearman, which was described as the type of its genus [*loc. cit.*], from a single female, is referred to the genus *Ectopsocus* as a result of the examination of many specimens of both sexes received from a cacao store in the Gold Coast. An error in the original description is corrected, and notes are given on variations in wing development among the specimens and on the male genitalia.

EDELSTEN (H. M.). *Pachyprotasis variegata* **Fallén (Hym., Tenthredinidae) on Potato.**—*Ent. mon. Mag.* **78** no. 943 p. 292. London, 1942.

Pachyprotasis variegata, Fall., was numerous on potato in Devonshire in 1941, causing considerable damage in some cases, and was also observed in July and August 1942 in Devonshire, Dorsetshire and Wiltshire. Larvae of this sawfly have not previously been reported on potato in Britain [*cf. R.A.E.*, A **15** 208; **27** 269]; although not generally common, it occurs locally throughout the south and at least as far north as Perthshire and Inverness; it has not been taken in Ireland.

THIEM (H.). **Ueber weitere Erfahrungen zur chemischen Bekämpfung der Maikäfer.** [Further Experience on chemical Measures against Cock-chafers.]—*Anz. Schädlingsk.* **18** pp. 16–19. 1942. (Abstr. in *Z. PflKrankh.* **52** pt. 9–10 p. 468. Stuttgart, 1942.)

Dinitro-ortho-cresol is not only an effective contact insecticide against adults of *Melolontha melolontha*, L., and *M. hippocastani*, F., but also acts as a stomach poison at low concentrations. Its residual action is considerable if the leaves are not severely scorched and persists as long as they retain their yellow discoloration. The main application of the dust should be made after the peak of emergence and before oviposition, and power dusters are preferable to treatment from aircraft. The problem of control is complicated if emergence is prolonged and if both Melolonthids occur in the same area. The percentage of dinitro-o-cresol in the dust should not be less than 10.

FLACHS (K.). **Die Trauermücke** *Neosciara solani* **Winn. als Schädling an Champignonkulturen.** [The Mycetophilid, *Sciara solani*, as a Pest of cultivated Mushrooms.]—*Prakt. Bl. Pflanzenb.* **19** pp. 1–20. 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 9–10 pp. 469–470. Stuttgart, 1942.)

The larvae of *Sciara* (*Neosciara*) *solani*, Winn., are occasionally serious pests of cultivated mushrooms in Germany, sometimes causing a total crop loss. They are also vectors of diseases and pests, especially mites. At 15–20°C. [59–68°F.] and high relative humidity, the life-cycle requires only 24–25 days. For control, manure should be well heated before being used on the beds, infested beds should be watered with nicotine solution, the adults should be trapped on strips smeared with adhesive, and contact poisons, especially pyrethrum, should be used in dusts, or preferably sprays, at short intervals.

SPEYER (W.). **Die Bekämpfung des Frostspanners im Rahmen der allgemeinen Schädlingsbekämpfung im Obstbau.** [Measures against the Winter Moth as Part of general Control of Orchard Pests.]—*Kranke Pflanze* **19** pt. 9–10 pp. 83–86. Dresden, 1942.

The tar distillates known as fruit-tree carbolineums, applied to fruit-trees in January–March at strengths of 5 per cent. for the heavy-oil preparations and at 8 or preferably 10 per cent. for the medium-oil or "emulsified" preparations [*cf. R.A.E.*, A **29** 231], are effective against the eggs of the lesser winter moth [*Operophtera brumata*, L.] in Germany. It has sometimes been recommended that copper compounds should be added to these sprays, but the author's experiments have shown that though the addition of 2 per cent. of a copper preparation increased the effectiveness of the emulsified carbolineum, it decreased that of carbolineums of the ordinary type. Mineral oils are also effective against the eggs, but dinitro-cresol has given variable results. Its effectiveness might be increased by the addition of mineral oil, but plums and damsons are easily injured by this combination.

The larvae can be controlled by stomach poisons if they are feeding openly on the leaves and buds, but neither stomach nor contact poisons are effective if they have bored into the unopened leaf-buds. The routine sprays before and after blossoming usually give good control, and calcium arsenate kills the larvae more quickly than lead arsenate. The safest method, however, is to apply both winter and spring treatments.

MASSEE (A. M.). **Notes on some interesting Insects observed in 1941.**—*29th Rep. E. Malling Res. Sta. 1941* pp. 47–51. East Malling, 1942.

Argyresthia nitidella, F., was recorded on cherry in four places in Kent in 1941 [*cf. R.A.E.*, A **28** 100] and is probably widely distributed there; it does not appear to persist in the same orchard and often causes considerable damage before its presence is recognised. The adults are active in June and July, and the eggs are laid under the bud-scales towards the end of July. Most larvae hatch in autumn and overwinter in silken cocoons, but some do not hatch until the following spring. They enter the buds and the fruits when they begin to develop, and each feeds on several fruitlets. They pupate in the soil at the end of May. A tar distillate applied in December tends to reduce this Tineid, and an atomised pyrethrum spray applied just after the blossom period was claimed to have given satisfactory control. Larvae of the winter moth [*Operophtera brumata*, L.] and allied species became progressively more injurious in 1939, 1940 and 1941, and the damage was increased in 1941 by prolonged cold in spring. Spraying was at times difficult or impossible, and partial defoliation was general in orchards in which it was performed with inadequate equipment. Considerable defoliation occurred in several cherry orchards that were sprayed with lead arsenate three times within a month, and two that were not sprayed were completely defoliated. Larvae from one of these migrated into a neighbouring orchard that had been sprayed and partially defoliated several rows of cherries.

Winged males and large numbers of wingless females of *Phigalia* (*Apocheima*) *pedaria*, F., occurred on the trunks and branches of bush apple trees in a plantation in February and March. This Geometrid has not previously been observed on fruit trees at Malling, although it is abundant on oak. Eggs were evidently deposited on apple, since several larvae were found feeding on the opening buds in April. *Psylla* (*Psyllia*) *mali*, Schm., is rare in the main apple-growing districts of Kent, but is still abundant in outlying districts and orchards that are not regularly sprayed.

Damage to pear by *Lygus pabulinus*, L., was reported near Rochester in 1940 and again in 1941, when infestation was severe at the beginning of the season on black currant bushes among pear trees, and migration to the latter evidently took place at the end of June. On pear, this Capsid fed only on the developing fruit, causing irregular pits on the surface and distortion ; in some cases corky patches developed on the skin. There was a similar attack in another pear orchard in which an outbreak had occurred ten years previously. Control measures comprised removing the black currant bushes or applying a dormant spray of oil emulsion. Several colonies of larvae of the sawfly, *Neurotoma flaviventris*, Retz., were found on the shoots and leaves of young pear trees, but did not cause any serious damage ; the protective tents containing these larvae should be destroyed as soon as they are formed in July. *Psylla* (*Psyllia*) *pyricola*, Först., is present in most seasons, but no outbreak had been recorded in Kent for 15 years. It was common on pear in 1940, and adults were abundant on the trees until the leaves had fallen. They were again common in 1941, when they bred on the trees. The winter is passed in the adult stage, and there is one generation a year. The nymphs occur singly, generally near the mid-rib, on the lower surface of the leaves.

A heavy infestation by *Incurvaria* (*Lampronia*) *capitella*, Clerck, occurred early in April 1940 on two varieties of red currant, but other varieties in the same nursery bed were not attacked. The larvae overwinter in cocoons on the shoots and enter the buds or shoots in spring, tunnelling in the latter and sometimes killing them. Pupation takes place at the end of April or in early May, and the adults emerge in late May. The outbreak was controlled by cutting off and burning the infested shoots.

Adults of *Psylliodes attenuata*, Koch, fed on the young leaves of hops in large numbers during May and June in the Malling district. They are present from early May until October, but are most numerous in May and June and again in September, when adults of the current year emerge. In 1941, little damage was caused in established hop gardens, but the beetles were unusually abundant in September and seriously injured newly-planted hops. *Euacanthus interruptus*, L., became more numerous in the hop garden in which it was recorded in 1940 [**30** 325] and caused a reduction in yield estimated at 1–2 cwt. per acre. The leaves of hop were infested by *Polygonia c-album*, L., and *Agromyza frontalis*, Mg., but neither is of great importance.

Leaves of grape vine received from a nursery in Worcestershire in 1940 and 1941 were found to be infested with *Eriophyes* (*Phytoptus*) *vitis*, Land., which has hitherto been recorded in England only from Berkshire in 1910 and Kent in 1928. The mites feed on the under surface of the leaves, producing small blisters on the upper surface and, where infestation is severe, causing the leaves to become wrinkled. They hibernate on the canes.

MASSEE (A. M.). **A Means of preventing Outbreaks of certain Pests in experimental Greenhouses.**—*29th Rep. E. Malling Res. Sta. 1941* p. 51. East Malling, 1942.

Established infestations by the red spider [*Tetranychus telarius*, L.] and Aphids on plants in glasshouses are very difficult to eradicate, but a simple means of preventing their establishment has been evolved at East Malling. Derris powder and soft soap are added to the water used for the routine "damping-down" of the plants at the rate of 1½ and 2 lb., respectively, per 100 gals. Each time that the tank becomes half empty, one-eighth of the initial quantity of derris and soft soap is added and the tank filled with water. The plants are thoroughly syringed each morning, noon and evening, and, provided that the mixture is well stirred before use, the reduced quantity of derris is sufficient to prevent the mites and Aphids from becoming established, probably owing to the accumulation of derris on the leaves. Hops, strawberries, raspberries, black currants and other plants in houses treated from the beginning of May until the end of autumn remained free from attack. When potted hop plants severely infested with *T. telarius* were transferred to a greenhouse in which this measure was employed, the mites were completely destroyed within two weeks and none of the other plants became infested. A thin deposit of derris accumulates on the leaves, but is readily removed by submerging the plants in water.

MASSEE (A. M.). **Aphis Transmission of Strawberry Crinkle in Great Britain.**—*J. Pomol.* **20** no. 1–2 pp. 42–48, 2 pls., 14 refs. London, 1942.

As *Capitophorus fragariae*, Theo., transmits the virus [*Marmor marginans* of Holmes] that causes the yellow-edge disease of strawberry [*cf. R.A.E.*, A **23** 291], and this disease is often associated with a mild form of crinkle [*M. fragariae* of Holmes] in the variety Royal Sovereign, experiments were carried out in south-eastern England to discover whether the Aphid also transmits the crinkle virus [*cf.* **27** 395]. On 4th June 1937, healthy plants raised from runners of a single plant of the common woodland strawberry, *Fragaria vesca*, which is considered to be free from both viruses in its natural habitat, were each infested with four adult apterous viviparous females of *C. fragariae* that had developed on a Royal Sovereign plant infected with mild crinkle, and control plants were infested with Aphids from a healthy plant. The Aphids were allowed to develop until the beginning of July and then killed. None of the controls developed the disease, but typical symptoms appeared on the other plants 17 days after the Aphids were transferred and were still present in late December. They also appeared in runners of the infected plants that were allowed to root but not severed from the parent plants; since none of these had been infested, the virus must have been transmitted along the stolon.

In a similar experiment in the following year, healthy plants of *F. vesca* all became infected when they were colonised on 29th May and only immature apterous viviparous females, up to and including the fourth instar, were used to start the colonies on them. A further experiment in 1941 demonstrated the ability of the alate viviparous females to transmit the mild and severe forms of the crinkle from Royal Sovereign plants infected with these forms of the disease, respectively, to healthy plants of the same variety. The Aphids were transferred on 26–28th May, which corresponds to the spring migration period [**30** 243]. In each of the three series of experiments, no plant exposed to infection escaped it.

Since individuals of so many different stages of *C. fragariae* can transmit the virus, it is imperative that complete control of the Aphid should be obtained in the field; this can be achieved by a recently developed method [**30** 326]. The general correspondence between the relative intensity of the induced symptoms and that of the symptoms shown by the plants from which the virus was obtained indicates that the mild and severe forms of the disease are etiologically distinct.

PARKIN (E. A.). **Symbiosis and Siricid Woodwasps.**—*Ann. appl. Biol.* **29** no. 3 pp. 268–274, 2 figs., 10 refs. London, 1942.

The following is substantially the author's summary. A reinvestigation of the association between fungi and the wood-wasps, *Sirex gigas*, L., and *S. cyaneus*, F. [*cf. R.A.E.*, A **22** 87; **26** 632; **27** 401] showed that a single species of fungus, *Stereum sanguinolentum*, is present in the intersegmental sacs situated at the anterior end of the ovipositor of adult females. The egg becomes infected with fungal oidia at the start of its passage down the ovipositor. When the egg has been deposited in timber, mycelial growth begins, and the fungus subsequently precedes the larva in its boring. The larva is probably, at least in part, mycetophagous. Modifications of the larval integument on the posterior aspect of the first abdominal segment were discovered. The structures so formed, termed hypopleural organs, contained fungal strands, which were cultured and identified as *S. sanguinolentum*. The organs are found in only some of the larvae, which suggests that they occur in female larvae only. Their fate during ecdysis or at pupation is unknown, and their importance in the symbiotic cycle cannot be assessed. No fungus could be detected in pupae, and it is thought that the fungus must grow from the walls of the pupal chamber into the intersegmental sacs of the immature female immediately after it emerges from the pupal skin.

GOUGH (H. C.) & EVANS (A. C.). **Some Notes on the Biology of the Click Beetles** *Agriotes obscurus* **L. and** *A. sputator* **L.**—*Ann. appl. Biol.* **29** no. 3 pp. 275–279, 12 refs. London, 1942.

The following is largely the authors' summary of investigations in Hertfordshire in 1939–40 on the sites preferred by adults of *Agriotes* spp. for oviposition and on their movements. In a laboratory experiment, females of *A. obscurus*, L., presented with a choice of oviposition sites, laid significantly more eggs in grass, and significantly fewer in a bare fallow, than in clover, wheat and kale, between which there was no significant difference. It is pointed out that the preference shown may be connected with food and not with oviposition, and that different results might have been obtained if there had been no choice. Marked adults of *A. sputator*, L., were caught up to 30 yards from the point at which they were liberated; this was the maximum distance at which traps were placed. The ratio of adults of *A. obscurus* to those of *A. sputator* in neighbouring arable and recently ploughed fields was found to vary from 1 : 62 to nearly 3 : 1.

GOUGH (H. C.). **Laboratory and Field Experiments on the Control of Wireworms.**—*Ann. appl. Biol.* **29** no. 3 pp. 280–289, 10 refs. London, 1942.

In a large-scale experiment in Hertfordshire in 1938 on the control of wireworms by means of insecticides, neither naphthalene at the rate of 15 cwt. nor calcium sulphide at the rate of 350 lb. per acre, applied broadcast in February and ploughed in, caused any decrease in the wireworm populations in soil under various crops. Laboratory tests were therefore carried out on larvae of *Agriotes* spp. by a technique that is described with various soil treatments, but no suitable new substances were discovered. Attention was then concentrated on determining whether wireworm control is influenced by the method of application of fumigants or fertilisers. In preliminary glasshouse tests with wheat sown in potted soil containing enough wireworms to correspond with an infestation of nearly 1,000,000 per acre, naphthalene or superphosphate applied in furrows near the seed effectively reduced damage to the seedlings; naphthalene applied in this manner had no deleterious effect on germination, as it had when applied broadcast or in the seed drills. A more elaborate experiment with barley did not give such good results.

WAIN (R. L.). **The Use of toxic Polynitro Derivatives in Pest Control. I. The Estimation of Dinitro-*o*-cresol and Dinitro-*o-cyclo*hexylphenol.**—*Ann. appl. Biol.* **29** no. 3 pp. 301–308, 28 refs. London, 1942.

The increasing use of 3 : 5-dinitro-ortho-cresol in winter washes against insect pests of fruit trees has rendered necessary the development of suitable methods of analysis for this compound alone and in oil emulsions. Previous work on the estimation of dinitro-o-cresol and related substances and their value as insecticides is reviewed, some of its general properties are given, together with five tests for it, and two simple methods for estimating dinitro-o-cresol and dinitro-o-cyclohexylphenol, by gravimetric and volumetric analysis, are described. The solubilities of salts of dinitro-o-cresol with the heavy metals are too high to permit their use in gravimetric estimation, but it was found that it readily forms compounds with a number of amines, heterocyclic bases, hydrocarbons and phenols, and some of the properties of 18 of these, and of

4 derived from dinitro-o-cyclohexylphenol, are given in a table. The compounds formed by dinitro-o-cresol with nitron and acridine and by dinitro-o-cyclohexylphenol with nitron are used in their gravimetric estimation.

FISHER (R. C.). **Furniture Beetles and other Wood-borers.**—*Ann. appl. Biol.* **29** no. 3 pp. 313–316. London, 1942.

The most serious pest of woodwork in houses in Britain is *Anobium punctatum*, DeG., which infests old furniture, the sapwood of roofing timbers, floorboards, joists and panelling. Little is known of its food requirements, but recent work in Germany indicates that the larvae are favoured by moisture [*cf.* *R.A.E.*, A **29** 234]. The sapwood of most timbers is attacked, and plywood is very suitable. Increased opportunities for infestation in houses and furniture have been brought about by war conditions and result from the storage of furniture in infested buildings, the favourable breeding conditions occurring in unoccupied houses that have become damp, and the use of unseasoned timber for building purposes. *Xestobium rufovillosum*, DeG., is often responsible for serious damage to structural timbers and sometimes panelling in old houses, as well as in churches, in which old oak timbers are present. Only wood that is decayed by fungi is attacked [*cf.* **30** 269, etc]. *Hylotrupes bajulus*, L., is not a serious pest in Britain [*cf.* **23** 155 ; **26** 378], and only 9 cases of infestation by it have been recorded since 1934. Some were in old buildings and others in imported packing cases. The present widespread use of unseasoned timber in buildings may lead to increased infestation. Wood-wasps of the genus *Sirex* occasionally emerge from built-in timbers in new houses but cause little damage. They are primarily forest insects and are associated with certain fungi [*cf.* **26** 632; **31** 142]. *Lyctus* spp. injure the sapwood of hardwoods and occur in new furniture or in the sapwood of recently erected oak beams, in panelling of walnut or oak. The larvae feed principally on starch [*cf.* **24** 8], and methods of producing starch-free timber that would be immune from attack have recently been investigated [**28** 450, 451 ; **29** 466]. *Ernobius mollis*, L., is sometimes present on the edges of coniferous timbers from which the bark has not been removed [**26** 463], and *Ptilinus pectinicornis*, L., is occasionally found in beech furniture.

The control of insects that bore in wood is difficult ; the methods used are treatment with liquid insecticides, which are not entirely satisfactory and may injure furniture, fumigation with hydrocyanic acid gas, which is largely limited to articles that can easily be handled, and heat treatment.

Brief reference is made to insects associated with wood other than borers. They include Lathridiids, *Cryptophagus* spp. and Psocids, which feed on moulds that develop on damp surfaces, and certain clothes moths, of which the larvae breed in cracks between floor-boards and behind skirting boards. The furniture mite, *Glycyphagus domesticus*, DeG., infests furniture stuffing of certain types and becomes numerous in damp premises [*cf.* **22** 543].

WILSON (G. F.). **The Invasion of Houses by Earwigs and Ants.**—*Ann. appl. Biol.* **29** no. 3 pp. 316–321, 24 refs. London, 1942.

This discussion is based partly on the literature and has special reference to conditions in Britain ; it is pointed out that information reported to local authorities on cases of infestation by household insects in Britain is not at present coordinated by any central body and is therefore not readily available to entomologists. Invasion of houses by *Forficula auricularia*, L., has increased in recent years, occurring chiefly on new housing estates, and also in newly-decorated rooms or bathrooms of old houses. In some cases, the earwigs have been so numerous that temporary evacuation and fumigation has been necessary. Mass invasions of houses have been attributed to the cover provided by rubble and builder's refuse on new housing estates, the unsanitary disposal of kitchen refuse, the odour of plaster, the moisture in newly-distempered walls and in bathrooms, and the shade provided by houses in built-up areas from which the natural cover provided by vegetation has disappeared. The population in a restricted area can probably be effectively reduced after a time by the use of baits [*cf.* *R.A.E.*, A **29** 538; **31** 131] and traps, since earwigs appear to migrate very little.

The most important ants in houses in the British Isles are introduced tropical species, which can survive in temperate regions only in buildings; these are *Monomorium pharaonis*, L., *Iridomyrmex humilis*, Mayr, *Pheidole megacephala*, F., and *Paratrechina longicornis*, Latr. *Lasius* (*Acanthomyops*) *niger*, L., *Ponera punctatissima*, Roger, and *Myrmica rubra* subsp. *ruginodis*, Nyl., are native species that occasionally enter houses, usually accidentally. *Monomorium pharaonis* feeds on bread, meat and sweet substances and nests within the cavities of walls, beneath floors and behind kitchen ranges. *I. humilis* is established in certain parts of the British Isles, where it has rendered houses temporarily uninhabitable; its food is similar to that of *M. pharaonis*. *Pheidole megacephala* has occasionally been recorded in hot-houses, bakehouses and restaurants, and *Paratrechina longicornis* in shops, houses and glasshouses.

Household ants are controlled by trapping, which rarely results in complete extermination, and the use of poison baits. The destruction of nests of *M. pharaonis* is generally impracticable, owing to their inaccessible position. In trials of various poison baits recently made over a period of three years, *M. pharaonis* was not attracted by one containing sodium arsenite and syrup [*cf.* **28** 98], and neither this species nor *L. niger* was attracted by baits containing derris. Three of the baits tested, including one of thallium sulphate [**15** 71], were effective against both species, and were sufficiently slow in action to enable the workers to carry them back to the nests.

MASSEE (A. M.). **Some important Pests of the Hop.**—*Ann. appl. Biol.* **29** no. 3 pp. 324–326. London, 1942.

The chief pests of hops in England are *Phorodon humuli*, Schr., *Tetranychus telarius*, L., and *Contarinia humuli*, Tölg, but the importance of *P. humuli* has been considerably reduced by improved methods of control. This Aphid overwinters in the egg stage in the bud axils of various species of *Prunus* (sloe, bullace, damson and, occasionally, plum), and feeds on the opening buds in early spring. The winged forms, which generally occur in mid-May and in some seasons persist until mid-June or later, migrate to hops, on which are produced several generations of apterous viviparous females that feed on the tips of the bines, frequently checking the growth, and attack the cones, where they may be very injurious. Alates are produced in September and October and migrate to other plants; those that settle on the winter food-plants give rise to oviparous females, which pair with males that have migrated from hops, and deposit the winter eggs. The Aphid is controlled by spraying the hops with nicotine after migration to them has ceased, followed by applications of nicotine dusts when necessary.

T. telarius is an important pest in Kent, where it persists in the same hop garden for years. The adult female mites overwinter in cracks in the hop-poles, in old training strings, in dried leaves, under stones, and in groups in the soil, and begin to feed on the lower surface of the leaves about the end of April. There is some varietal difference in susceptibility to attack. Oviposition begins towards the end of May, and the eggs are deposited on the lower surface of the leaves under a silken web. Four or more generations are produced during the season, and in August and September, when infestation is highest, all stages are present. The cones become infested as soon as they are formed, and when severely attacked, are brown, brittle and undersized. Control is obtained by spraying with lime-sulphur in May or June [*R.A.E.*, A **30** 330].

The adults of *C. humuli*, which is less generally distributed [*cf.* **30** 326], appear at the end of July and in August, and the females deposit eggs under the scales of the developing cones. The larvae, 40 or 50 of which may occur in a single cone, are present from the second week in August until mid-September, tunnelling in the peduncles and checking the development of the cones. They begin to leave the cones at the end of August and enter the soil, where they overwinter. There is one generation a year. Satisfactory control was given in experiments in which derris and nicotine dusts were applied against the adults in late July before oviposition had begun and a derris dust was later applied to the soil just before the larvae left the cones.

The flea-beetle, *Psylliodes attenuata*, Koch, and the Capsid, *Calocoris fulvomaculatus*, DeG., are important locally, though outbreaks are rare. The former causes severe damage only when weather conditions check the growth of the bine. The adults, which attack the leaves and cones, overwinter among dead leaves, etc., and resume feeding in May. The immature stages occur in the soil, and the larvae feed on the roots of various plants, including hops. There is one generation a year. The adults can be controlled by derris dusts applied in May, and injury is decreased by the use of fertilisers and the removal of surplus bines, to stimulate growth. *C. fulvomaculatus* is common where the " pole-work " method is practised. Eggs are deposited in the softer parts of the poles in August, and the nymphs hatch at the end of the following May. They feed on the leaves and bines, and as a result of feeding on the tips, the bines cease to grow. Adults are present in late June and July. The active stages are controlled by nicotine or derris sprays applied to the bines and the soil beneath them at the end of May, when hatching is complete. The overwintering eggs can be destroyed by spraying the stacks of poles with a 8 per cent. oil emulsion or dipping the poles into it.

The insect fauna of hops shows considerable variation in different districts and from year to year. *Phorodon humuli* is ubiquitous, but *Euacanthus interruptus*, L. [*cf.* **30** 326] and *Contarinia humuli* may cause serious damage in one garden and yet be absent from neighbouring ones of the same variety, although abundant on wild plants round them, and *C. humuli* may disappear from gardens in which it has persisted for years, new outbreaks occurring in widely separated and previously uninfested districts.

In experiments carried out over three years, the viruses of hop nettlehead [*Chlorogenus humuli* of Holmes] and hop mosaic were not transmitted by *Psylliodes attenuata* and *Empoasca flavescens*, F., which are considered to be vectors by European workers, *Typhlocyba rosae*, L., or *Phorodon humuli*, which always occurs in gardens in which the diseases are present, and that of mosaic, was not transmitted by *Euacanthus interruptus* or *Tetranychus telarius*.

Finney (D. J.). **Examples of the Planning and Interpretation of Toxicity Tests involving more than one Factor.**—*Ann. appl. Biol.* **29** pp. 330–332, 5 refs. London, 1942.

In this discussion of the design of tests of the toxicity of insecticides, the author emphasises the desirability of employing a factorial arrangement of treatments, including all possible combinations of several levels of each of the factors tested, and illustrates his remarks by reference to experiments performed by himself and other workers.

Statistical analysis of experiments to compare the mortality of *Tribolium confusum*, Duv., due to pyrethrins in oil applied by the film technique [*R.A.E.*, A **31** 85] and by the normal spray technique showed that the toxicity of the spray applied by either technique was increased to the same extent when the concentration of pyrethrins was doubled and when the weight of the deposit of spray in the dish containing the insects was increased fourteen times. This result was apparently influenced by the absorptive properties of the surface (tricoline) on which the insects were treated, since when it was replaced by hardened filter-paper, toxicity was increased to a greater extent by an increase in deposit than by increased concentration. If the total amount of pyrethrins in the deposit were the only important factor, mortality would be determined by the product of the concentration and the weight of the deposit, and the same effect would be obtained when either was doubled. Mortality was higher from the spray than from the film technique; the difference, which was slight, was constant for all concentrations and deposits tested.

In a discussion of the toxicity of mixtures of insecticides, in which the factors involved are the proportions of the constituents and the concentration of the mixture, the author states that the terms " synergism " and " antagonism " have been used to describe modes of action of mixtures in which the toxicities are respectively greater and less than those predicted from the separate constituents, but that the basis to be employed for the prediction has not been clearly defined. He therefore suggests that these terms should be reserved for toxicities that are higher and lower, respectively, than those predicted by similar action [*cf.* **28** 200] and gives an analysis of data obtained by Le Pelley & Sullivan [**25** 34] in experiments on the toxicity of rotenone and pyrethrins and mixtures of the two to house-flies [*Musca domestica*, L.], in which synergistic action is demonstrated.

BORTON (A. E.). **The Control of Rhododendron Bug with an atomized Pyrethrum Extract.**—*J. R. hort. Soc.* **67** pt. 10 pp. 337–338. London, 1942.

It is reported that an infestation of *Stephanitis rhododendri*, Horv., on rhododendron over an area of ¾ acre was successfully controlled by applications of an atomised pyrethrum extract made during the first week in June, on 16th or 17th June and at intervals during July as they became necessary, and that the shrubs looked more healthy after treatment than they had for two years. Bushes that were saturated with the oil used in the mixture showed no ill effects. Two persons were able to treat the area thoroughly with a portable atomising plant and knapsack sprayer in about two hours.

EDWARDS (E. E.) & DAVIES (T. I.). **War on the Pests of ploughed-up Grassland.**—*Pamphl. Bath W. S. Co. Soc.* no. 5, [4+] 23 pp., 4 pls. Bath, 1942.

In view of the increased difficulty in Britain of protecting crops from pests, owing to the ploughing up of grassland, the authors give the results of a rapid survey in Glamorgan and Monmouthshire in 1941 of failing cereal crops on land in the first two seasons after the breaking up of the grass, which indicated that wireworms and Tipulids are by far the most important causes of failures. Notes are also given on the life-histories and control of the commonest insect pests, which, in addition to wireworms and Tipulids, comprise cutworms, cockchafer larvae, and the frit-fly [*Oscinella frit*, L.]. The wireworm survey that has been in progress for the last three years is described, and precautions to be taken on grassland and stubble containing various populations of wireworms are given.

HOGAN (T. W.). **The Gooseberry Weevil** (*Ecrizothis inaequalis* **Blkb.).**—*J. Dep. Agric. Vict.* **40** pt. 7 pp. 377–378, 3 figs. Melbourne, 1942.

Ecrizothis inaequalis, Blkb., which apparently occurs only in the southern half of Victoria, normally lives on indigenous plants such as dogwood (*Cassinia*) and daisy bush (*Olearia*), to which it does no serious damage, but has caused economic injury to certain introduced plants, including gooseberry and raspberry, in some districts. Though the weevils have been known to kill first-year raspberries, the gooseberry is the only crop that is attacked to any great extent. In seasons favourable to early emergence, the adults feed on the young buds as they are opening, preventing the production of fruit. In other seasons they eat into the stems of the young shoots and cause them to break off or dry out ; new shoots are produced to replace those destroyed, and this may affect the health of the plant over a number of years. In addition, the larvae feed on the roots, sometimes causing more damage than the adults.

The eggs are laid in the surface layer of the soil towards the end of November ; the larvae hatch after several days and burrow into the soil, where they feed on roots and overwinter at a depth of one foot or less, pupating within about three inches of the surface in early spring. The pupal stage lasts about three weeks, and emergence of the weevils takes place over a period of approximately six weeks. The adults feed voraciously at night for 4-6 weeks and may migrate from one bush to another if food is scarce. A spray containing 5 lb. lead arsenate and 1 pint white spray oil in 80 gals. water, applied when the weevils first appear or when the first green shoots show on the plant and again about three weeks later, particularly to the young shoots, gives the most satisfactory control. A dust containing 50 per cent. lead arsenate applied at the same times is effective, but less so than the spray.

TAYLOR (J. S.). **Notes on some South African Lepidoptera.**—*Ent. Rec.* **54** no. 10 pp. 111–113. London, 1942.

Further data are given on the duration of the larval diapause of *Loxostege frustralis*, Zell., a pest of *Pentzia incana*, which is the principal fodder-plant in the Karroo district of South Africa [*cf. R.A.E.*, A **30** 5]. Larvae that entered the soil in November 1939 were kept under extremely dry conditions, and adults continued to emerge from the cocoons constructed by them until January 1941 ; the time passed within the cocoon by 46 examples varied from 314 to 424 days. Cocoons from which there had been no emergence were opened in June 1941 and living larvae were found in three of them. A larva in a cocoon that was opened 218 days after its formation pupated 4–5 months later, and the adult emerged 365 days after the construction of the cocoon. Larvae in several other cocoons that were opened in June 1940 pupated in the following September and October, and adults emerged at the end of the latter month. Several adults of a species of *Macrocentrus* that parasitises the larvae were obtained 382–399 days after the formation of cocoons by the host larvae. *L. frustralis* was not a serious pest in 1940–41 or up to February 1942, and this is attributed to unfavourable conditions produced by the dry summers in both years.

Other Lepidoptera on which brief notes are given include *Theretra capensis*, L., and *Hippotion* (*Chaerocampa*) *celerio*, L., the larvae of both of which feed on the leaves of grape vines, and *Tathorhynchus vinctalis*, Wlk., larvae of which feed on lucerne and construct cocoons among leaves and débris at the base of the food-plant, all in Cape Province.

SILVA (P.). **Seção de biologia.** [Section of Biology.]—*Relat. Inst. Cacau Bahia 1938* pp. 53–64 ; *1939* pp. 67–76. Bahia, 1939, 1940. [Recd. 1943.]

The first of these reports from the Bahia Cacao Institute includes a list of injurious insects and a few Hymenopterous parasites observed during 1938 in Bahia, showing the plants on which the former were taken, and the second, a note on *Citrus* pests in southern Bahia and a list of 12 Tingids collected from various plants, some of economic importance.

DARLING (H. S.). **The Effect of Light on the Incidence of Cacao Thrips.**—*Trop. Agriculture* **19** no. 8 pp. 151–162, 1 graph, 17 refs. Trinidad, 1942.

In Trinidad, where cacao is grown under permanent overhead shade provided by *Erythrina*, the reduction of this shade is often followed by increased infestation by *Selenothrips rubrocinctus*, Giard, and the investigations described were carried out to determine the extent to which the increased amount of light affects the incidence of the thrips. Statistical analysis of the data obtained in surveys made during November and December 1941 showed that the number of thrips per 100 leaves and the number of nymphs per adult were both significantly higher on unshaded plants (219 and 3·03) than on shaded ones (30 and 2·16) The higher proportion of nymphs on unshaded plants suggests that reproduction is more rapid, and this would adequately account for the larger populations.

Comparisons of infestation on cacao grown in the light, in the shade and intermediately were carried out with three sets of plants in a greenhouse that had the eastern half of the roof shaded with black cloth. During the last fortnight of October 1941, each plant was infested with 100 pupae of the thrips, and in addition, 200 adults were released among the plants in each group ; population counts were made at intervals of 3–10 days from 3rd November until 14th February. By the end of the experiment, the populations of thrips per sq. m. leaf surface were 706 on plants in the western third (light), 372 on those in the middle (intermediate) and 186 on those in the eastern third (shade). Thrips development was more rapid in the light than in the shade, and assessments of the damage to the plants showed that by the standards of field practice, the cacao grown in the light suffered more than 20 times as much as that grown in the shade, 21·46 per cent. of the leaves being severely damaged in the former and 0·94 per cent. in the latter. In February, to determine the extent of migration of thrips adults from plants under shade to plants receiving more light, the plants that had been grown in the light were transferred to the shaded third of the greenhouse, and some of those from the intermediate treatment were placed in the middle and western thirds, after the thrips had been removed from them ; the other plants were taken away. Daily counts of adults that moved to the depopulated plants showed practically no evidence of migration from shaded to unshaded cacao, and it is considered that light played little or no part in such migration as did take place.

Laboratory studies carried out between October 1941 and February 1942, in which nymphs in the first and second instars were allowed to choose disks of cacao leaves from different sources for food, showed no significant difference in the numbers on leaves from nine plants of the variety used in the greenhouse tests that were grown under similar conditions or on leaves from plants that had been in the light, shade and intermediate treatments for 24 hours, but significant differences between the light and shade treatments after a few days, two weeks and a month ; the results obtained with leaves from the intermediate treatment were variable. These results were confirmed by tests with leaves collected in shaded and unshaded positions in the field, in which the latter were significantly more attractive than the former. It is concluded that light accelerates reproduction and development of the thrips by modifying the cacao.

SPEERS (C. F.). **The Pine Spittle Bug** (*Aphrophora parallela* **Say**).—*Bull. N. Y. St. Coll. For.* **14** no. 2–a, 65 pp., 25 figs. Syracuse, N.Y., 1941. (Abstr. in *Exp. Sta. Rec.* **87** no. 3 p. 398. Washington, D.C., 1942.)

An account is given of studies on *Aphrophora parallela*, Say, which is indigenous in the United States, where it is widely distributed throughout the eastern coniferous region and is the most important pest of *Pinus sylvestris* [*cf. R.A.E.*, A **30** 587]. Injury first appears at the tips of the lower branches and progresses upwards, killing the larger branches. If the attack is not checked, the tree dies two or three years after the first appearance of damage. The winter is passed in the egg stage in dead twigs or in the outer layers of bark on small twigs. The nymphs hatch when the buds begin to swell in May and, after passing through five instars, complete their development during the latter part of July and the first part of August. Oviposition begins about a week after the adults appear and continues until the second week in September. In addition to *P. sylvestris*, the food-plants of this Cercopid include European larch [*Larix decidua*], Japanese red and Japanese black pine [*P. densiflora* and *P. thunbergi*], lodgepole pine [*P. contorta*], western yellow pine [*P. ponderosa*], limber pine [*P. flexilis*], Austrian pine [*P. nigra* var. *austriaca*] and hemlock [*Tsuga*], and *P. sylvestris* is as liable to attack when growing in mixed stands containing other conifers as it is in pure stands. *A. parallela* can be controlled on ornamental trees and in small isolated forest areas, where there is little risk of reinfestation, by spraying, preferably in early June, with a pyrethrum extract in water. Under forest conditions, the only practicable control is by silvicultural measures, including properly-timed thinning to encourage vigour and increased growth, and the removal of dead and dying branches, dying trees, etc., in which the Cercopid oviposits.

BECKWITH (C. S.). **False Yellowhead Fireworm.**—*Proc. Amer. Cranb. Gr. Ass.* **72** pp. 23–25. 1942. (Abstr. in *Exp. Sta. Rec.* **87** no. 3 p. 401. Washington, D.C., 1942.)

The addition of lead arsenate (4 lb. per 100 U.S. gals.) and nicotine sulphate (1 : 500) to the regular spray of Bordeaux mixture gave sufficient control of *Sparganothis sulfureana*, Clem., on cranberry in New Jersey to prevent browning of the foliage, but not enough to prevent the production of an injurious second generation. Repeated applications of lead arsenate year after year appear to increase the severity of infestation, and general observations indicated that the spray reduced the parasites to such an extent that the second generation of larvae of *Sparganothis* was greater than it would otherwise have been. The bogs in which the observations were made were drained early, however, which limited the effectiveness of the spray. It is thought that good control would have been obtained if draining had been delayed in order to concentrate the appearance of the larvae, and if the applications had been adequate and properly timed, and that the measure is more suitable for smaller bogs.

THOMPSON (G. B.). **The Filbert Worm Problem.**—*Rep. Ore. St. hort. Soc.* **33** pp. 127–128. 1941. (Abstr. in *Exp. Sta. Rec.* **87** no. 3 p. 401. Washington, D.C., 1942.)

A brief account is given of the filbert worm [*Cydia latiferreana*, Wlsm.], which was very injurious in some groves of filberts [*Corylus avellana*] in Oregon in 1941. Eggs were deposited on filberts over a much longer period than in previous years, but despite this extended oviposition period and the heavy infestation, good control was obtained in most experimental tests. A spray containing 3 lb. lead arsenate and a spreader in 100 U.S. gals. water is recommended. The importance of destroying the larvae that leave the nuts during the drying process is emphasised.

In the discussion that followed, S. M. Dohanian referred to the observation made in California that the variety of this species that breeds in filbert also attacks Catalina cherry [*Prunus lyonii*] [*cf. R.A.E.*, A **31** 108] and to experiments in Oregon that indicated that acorns were the original source from which filbert groves became infested.

JONES (E. W.) & SHIRCK (F. H.). **The seasonal vertical Distribution of Wireworms in the Soil in Relation to their Control in the Pacific Northwest.**—*J. agric. Res.* **65** no. 3 pp. 125–142, 4 graphs, 7 refs. Washington D.C., 1942.

The following is substantially the authors' summary. In 1931–37, observations on the seasonal vertical distribution of wireworms were made near Walla

Walla, Washington, and Parma, Idaho, where the predominant species were *Pheletes* (*Limonius*) *canus*, Lec., and *P.* (*L.*) *californicus*, Mannh., respectively. By arranging these observations regularly in restricted areas of fairly heavy infestations, it was possible to study trends in numbers of wireworms at different depths in relation to soil temperature, moisture and cropping conditions. A total of 10–20 soil units, 1 sq. ft. in area, were examined for wireworms on each observation date. Each unit area was dug in 3-inch layers to a depth of 18 or 24 ins. Observations were made in a spinach field of sandy-loam type and in fallow, lucerne and potato fields of silt-loam type at Walla Walla, and in fallow, potato and maize fields of clay-loam type at Parma.

In spring, there is an upward migration of the wireworms from the subsoil to the surface layers when temperatures range from 40 to 68°F. at the 6-inch depth. In the summer under exposed soil-surface conditions, such as fallow or lightly shaded soil, when surface temperatures of 75°F. and above are reached, they leave the surface 3 ins. and return to deeper layers, but on densely shaded ground they remain in the top 6 ins. of soil more consistently and throughout most of the summer. Wireworms move down as the soil becomes dry, and after it becomes wet from rain or irrigation following a dry period, they move up again towards the surface.

The vertical distribution of wireworms has a direct relation to control recommendations. Careful planning to avoid sowing early in May will tend to minimise the loss of seed of summer crops from wireworm feeding. The late-planted (June) potato has also a greater chance to escape damage than the early-planted potato. A fumigant such as carbon bisulphide would be most effective in July, August and September, whereas a more poorly diffusing chemical, such as naphthalene, would be effective during April, May and June. The time to attract wireworms to baits is also when the largest numbers are in the upper few inches of soil.

Lindgren (D. L.). **Fumigation in Red Scale Control.**—*Calif. Citrogr.* **27** no. 11 pp. 308–309, 324. Los Angeles, Calif., 1942.

Tent fumigation of *Citrus* with hydrocyanic acid gas in different parts of California at a dosage of 20 cc. [per 100 cu. ft.] resulted in more than 99 per cent. control of non-resistant strains of the red scale [*Aonidiella aurantii*, Mask.] but not more than 93·5 per cent. of resistant ones; the percentage mortalities of the latter given by dosages of 26 and 28 cc. were 97 and 98·7, respectively. In some areas in the interior, this Coccid is not only more difficult to kill with HCN, but also develops more rapidly than in some coastal sections, producing up to 3½ generations a year, as compared with only two. In general, the initial kill of *A. aurantii* with oil sprays is lower than with fumigation, even with a heavy-medium or heavy oil, but the sprays have a residual effect that hinders the settling and development of crawlers, to an extent depending on the grade of oil used and the weather conditions after spraying. Any injury caused to the trees by fumigation appears within 7–10 days and is rapidly overcome, unless it is very severe, but oil sprays may cause either acute or chronic injury. Orange trees are more susceptible to oil-spray injury than lemons and should not be sprayed with an oil heavier than the light-medium grade; as this does not give satisfactory control of the scale alone, treatment of orange trees should consist in fumigation or in spraying and fumigation if infestation is heavy. Lemon may be sprayed with medium oil, fumigated or given both treatments for a severe infestation.

The results of laboratory experiments are cited, showing that the yellow scale [*A. citrina*, Coq.], another species of importance in the interior of California, is slightly more difficult to control by fumigation than the non-resistant *A. aurantii*, but less difficult than the resistant strain.

Rau (G. J.). **The Canadian Apple Mealybug,** *Phenacoccus aceris* **Signoret, and its Allies in northeastern America.**—*Canad. Ent.* **74** no. 7 pp. 118–125, 27 figs., 9 refs. Guelph, Ont., 1942.

Two mealybugs have become serious pests of apple in North America within the past few years ; in Virginia, *Pseudococcus comstocki*, Kuw., has produced a strain that has become well adapted to apple [*cf.* *R.A.E.*, A **24** 722], and in Canada, *Phenacoccus aceris*, Sign., which was apparently introduced from Europe into Maine and has spread into Nova Scotia and British Columbia, has become a serious pest of apple in Nova Scotia [**25** 366, etc.] and of apple and cherry in the Kootenay Valley, where it has also attacked currant [and has been recorded as an unidentified mealybug or as *Pseudococcus* sp. (**23** 715 ; **29** 330, etc.)]. The author discusses the present confusion regarding the identification and generic attribution of species of *Phenacoccus* and *Pseudococcus*, enumerates the characters of both sexes of the genus *Phenacoccus* and describes the adult female and the second or overwintering stage of *P. aceris* ; from an examination of the type material of the Japanese *P. pergandei*, Ckll. [*cf.* **19** 142 ; **25** 226], he considers that it is a synonym of *P. aceris*.

The economic importance of the mealybug in Nova Scotia and British Columbia is due chiefly to the honeydew, which covers leaves and fruit and forms a good medium for the development of a sooty fungus that can only be removed by washing, but if infestation is severe the flow of sap may be so arrested that the fruit drops or the branches die. Its status elsewhere is reviewed from the literature [*cf.* **3** 744 ; **9** 416 ; **19** 142 ; **21** 263]. The immature larva of *Allotropa utilis*, Mues., which was reared from *P. aceris* in Nova Scotia [*cf.* **28** 123], is described, and it is stated that this Scelionid has been introduced into British Columbia. A key to the eight species of *Phenacoccus* known in north-eastern America is followed by notes on the seven indigenous species, including the bionomics and natural enemies of some of them. One of them is *P. dearnessi*, King, with which *P. aceris* was confused when it was first found in North America [*cf.* **23** 680].

Marshall (J.). **The Apple Mealybug** *Phenacoccus aceris* **Sig. and its Control by dormant Spray.**—*Sci. Agric.* **22** no. 12 pp. 727–732, 3 refs. Ottawa, 1942.

Although *Phenacoccus aceris*, Sign., which feeds on apple in British Columbia [*cf.* preceding abstract] causes no direct injury, the sooty mould that develops on its honeydew renders the fruit unsaleable without careful washing. This mealybug has one generation a year [*cf.* *R.A.E.*, A **23** 680]. The immature females leave their winter cocoons during the first warm days of February and March, feed on the twigs and fruit spurs and become adult at about the end of April in the Kootenay Valley. They pair with the males, which emerge from their cocoons at this time, and then feed for 2–3 weeks before ovipositing. The eggs are laid in masses of 200–500 on twigs, branches or trunks, and the crawlers hatch in 5–6 weeks, generally from the end of June, and feed for two months or longer before migrating to the sheltered positions in which they form cocoons [*cf.* *loc. cit.*].

A summary is given of the results of field experiments carried out in 1939–41 to discover less expensive spray materials than the 6 per cent. dormant oil or the mixture of 4 per cent. dormant oil and 6·5 per cent. lime-sulphur (30–32°Bé.) that were previously recommended for the control of the mealybug. Specifications of most of the substances tested are given. The sprays were applied at the delayed dormant period, after the females had left their cocoons and established themselves on the twigs to feed, and counts of egg-masses and adults were made about two months later. At concentrations of 2 or 4 per cent., petroleum oil (California crude), emulsified with ½ or 1 lb. sulphite lye (lignin pitch) per 100 gals., was more effective when its viscosity was 108 secs. Saybolt at 100°F. than when it was 223, 44 or 32 secs., but 6 per cent. of the oil of viscosity 44 secs. (Diesel oil) was as effective as 4 per cent. of the oil of medium viscosity and much cheaper. It caused no injury to the buds. The addition of 2 per cent. lime-sulphur to 2 per cent. oil of 44 or 108 secs. viscosity increased its toxicity and residual effect ; the greater cost of such a mixture, however, appears to outweigh this advantage. The toxicity of sprays containing 2 per cent. oil of 108 secs. viscosity or 4 per cent. oil of 32 secs. was increased by the addition to the oil of 6 oz. 3, 5-dinitro-ortho-cresol or 2, 4-dinitro-6-cyclohexylphenol per 100 gals. spray and that of 2 per cent. oil (44 secs.) by 3 oz. dinitro-cresol, and still further increased by the addition to the water of 4 oz. oxalic acid, which reduced its pH value from 7·5 to 4·5 and prevented the transference of the dinitro compound from the oil to the water phase and the formation of water-soluble salts [*cf.* **27** 649]. The degree of refinement of the oils varied, but it is doubtful whether this had an important effect on the results. Aqueous solutions of sodium dinitro-cresylate or -cyclohexylphenate, prepared by stirring 0·6 lb. powdered dinitro-cresol or dinitro-cyclohexylphenol into a solution of 0·5 lb. sodium carbonate or 0·2 lb. sodium hydroxide in hot water and making the mixture up to 100 gals. with 1 oz. sodium lauryl sulphate as an adjuvant, gave control comparable with that obtained from the most effective oil spray and were cheaper. The dinitro-cresylate seemed to be rather less effective than the dinitro-cyclohexylphenate, but was less expensive and less objectionable to apply.

BALCH (R. E.). **On the Estimation of Forest Insect Damage, with particular Reference to** *Dendroctonus piceaperda* **Hopk.**—*J. For.* **40** no. 8 pp. 621–629, 7 refs. Washington, D.C., 1942.

The author considers that in estimating that the loss of timber due to infestation of spruce by *Dendroctonus piceaperda*, Hopk., in Canada is unimportant because it is less than the surplus over industrial requirements [*R.A.E.*, A **30** 362], A. R. Gobeil neglected fundamental facts about the growth and use of forests and made unwarranted assumptions as to the nature of the attack, giving little consideration to the distribution of the dead trees, the type of forest affected or the changes produced in operating conditions and logging costs in the various watersheds.

In the present paper, which is based on observations made in the Gaspé Peninsula during 1932–41 in connection with the study of *Gilpinia hercyniae*, Htg., on spruce and particularly on data obtained each year on portions of the upper drainages of the Cascapedia and Ste. Anne rivers, he discusses the relation between the present outbreaks of *G. hercyniae* and *D. piceaperda* [*cf.* **29** 37, etc.] and describes the nature of the Gaspé forest, the greater part of which is mature and consists of mixed stands of uneven-aged balsam fir [*Abies balsamea*] and spruce, which are comparatively resistant to windfall and fire and capable of maintaining their identity and high merchantable volume per acre more or less indefinitely, the distribution of the damage within the forest and the types of tree attacked by *Dendroctonus*. He shows that the bark-beetles attack chiefly the large slow-growing trees, which provide most timber per acre, and not only cause considerable loss of volume of trees, but also disturb the stand so that further deterioration results, since the removal of the spruce exposes the balsam to windfall and sun scald ; balsam stands of even age must be cut relatively soon after they reach maturity, or they deteriorate ; the presence of dead tree stumps and fallen trees increases the danger of fire ; and the reduction of the dense stands of wood of good quality with a high yield on accessible sites and the presence of fallen trees, which constitute a serious obstacle to cutting, greatly increase the costs of operation. Taking into consideration when the area would have been cut, what the probable condition of the stand at this time would have been and what it will be as a result of insect damage, the author gives rough estimates of the damage caused in part of the Gaspé area; these are much higher than those given by Gobeil. He discusses the salvage of dead trees and the silvicultural control of *Dendroctonus*, which is likely to become a minor pest when all the virgin forest has been cut and all spruce forests are managed on a rotation of 100 years or less.

BLICKLE (R. L.). **Penetration of Oils into Insect Eggs. a. Influence of Oil Characteristics. b. Influence of Age of Egg and of Species. Studies of Contact Insecticides XVI.**—*Tech. Bull. N. H. agric. Exp. Sta.* no. 79, 14 pp., 3 graphs, 20 refs. Durham, N.H., 1942.

The results are given of experiments to ascertain the rates of penetration of certain petroleum oils, glycerides (vegetable oils) and terpenes (pine oil and, in the last experiment, turpentine) through the chorion of eggs of *Periplaneta americana*, L., *Leptinotarsa decemlineata*, Say, and *Epilachna varivestis*, Muls.; the eggs were placed in oil saturated with a suitable dye, removed at definite intervals and sectioned. The cockroach eggs were allowed to develop for three weeks and then removed from the ootheca for the tests; the other eggs used were of all ages.

The rate of penetration of petroleum oils increased as the viscosity and unsulphonatable residue decreased, and glycerides penetrated rather more slowly than petroleum oils of similar viscosity; refined glycerides appeared to penetrate more rapidly than crude ones. Above 25°C. [77°F.], the rate of penetration increased substantially with increased temperature, but the decrease below this was not marked and occurred only with oils of higher viscosity. In general, penetration took place most rapidly into the unprotected eggs of *P. americana* and least rapidly into those of *E. varivestis*. Experiments with eggs of the latter of varying ages and pine oil showed that the rate of penetration increases with the age of the egg, indicating that the egg membranes become more permeable to oils as embryonic development advances. Eggs allowed to remain in the oils for prolonged periods shrivelled and collapsed, probably owing to loss of water. The terpenes caused the greatest loss in weight of cockroach eggs and the mineral oils the least. Eggs immersed in distilled water gained in weight.

CHESNOKOV (P. G.). **World's Assortment of Oat Varieties in Relation to the Swedish Fly.**—*C. R. Acad. Sci. URSS* (N.S.) **27** no. 7 pp. 718–721, 1 map, 7 refs. Moscow, 1940. [Recd. 1943.]

Tests were made near Leningrad of the susceptibility to attack by *Oscinella frit*, L., of 162 forms of the cultivated *Avena sativa* and of 28 of 5 other cultivated and wild species of oats that occur in various parts of the world. Resistance was estimated on the bases of liability to infestation and ability to withstand the injury due to it, and the results are given in a table that shows, for each species, the number of forms tested, the countries from which they were obtained, the highest and lowest percentages of plants infested, and the highest and lowest percentages that gave no yield of crop. It is concluded that susceptibility to attack has not been increased by progressive cultivation, and that a cultivated species with a wide distribution and many varieties shows greater variation in susceptibility than a species with a narrow distribution, though some wild species that are widespread are uniformly susceptible. The variation in susceptibility within widely-distributed species is correlated with adaptation to different ecological and geographical conditions; no single character, such as earliness or xerophily, determines resistance, but the varieties that are native to the region where the fly is highly injurious are less susceptible to attack than those native to regions where it is not.

BRAIN (C. K.). **The Tobacco Aphid. Destruction of Winter Host Plants.**—*Rhod. agric. J.* **39** no. 4 pp. 241–243, 1 pl. Salisbury, S. Rhod., 1942.

The use of insecticides against *Myzus persicae*, Sulz., on tobacco in Southern Rhodesia is unsatisfactory, since large quantities of spray materials are required, the plants are damaged by any spray that is effective against the adult Aphids, commercial dusts are ineffective and either sprays or dusts are harmful to the Syrphid larvae that constitute the most valuable natural control. Recent investigations indicate, however, that the destruction of the plants on which the Aphid passes the dry season is likely to be the most important means of control. In Southern Rhodesia, there appear to be two strains of *M. persicae*, neither of which has been found on peach ; one occurs in gardens from December to March, most commonly on cabbage, radish and turnip and rarely on potato, and has not been found in the dry season ; the other appears to be restricted to tobacco in the growing season and to *Gynandropsis pentaphylla* in the dry season. This plant, which is described, apparently occurs throughout Africa north of the Transvaal and Bechuanaland and also in India and Ceylon ; it is grown in native compounds and used as a spinach during the rains and often persists throughout the winter where the soil is moist enough. The Aphid appears to spend the end of the winter hibernating in the fourth instar ; it was found in this stage on green plants of *G. pentaphylla* towards the end of August 1941, and on small clusters of very small leaves on plants that appeared at first sight to be dead. It is therefore necessary that all plants of this species should be destroyed throughout the winter, whether they appear to be alive or dead. The closely related cultivated plant, *G. speciosa*, should not be grown on tobacco farms during the winter, as *M. persicae* was found infesting it at Salisbury in May 1942.

HOPKINS (J. C. F.) & PARDY (M. H.). **Diseases of Fruit, Flowers and Vegetables in Southern Rhodesia. 6. Virus Diseases of Cabbages and Cauliflowers.**—*Rhod. agric. J.* **39** no. 5 pp. 376–383, 3 pls., 8 refs. Salisbury, S. Rhod., 1942.

Descriptions are given of the symptoms of a mosaic disease of cabbage and a dwarf disease of cauliflower, which are caused by distinct viruses that have each been transmitted experimentally by the Aphids, *Myzus persicae*, Sulz., and *Brevicoryne brassicae*, L., and by mechanical inoculation ; both diseases were transmitted to cabbage and cauliflower and the mosaic to kohlrabi and the dwarfing disease to *Nicotiana glutinosa*. In the field they are probably spread only by Aphids. The development of cabbage mosaic, which is believed to be identical with the disease reported from Wisconsin [*R.A.E.*, A **28** 321], is favoured by high temperatures (75–95°F.), whereas cauliflower dwarfing disease is possibly caused by a mixture of viruses, one of which becomes active at temperatures of about 35–65°, and the other at high temperatures.

Control measures include growing the plants only in the cooler months (May–August), removing weeds and plant refuse, which harbour the viruses and serve as food for the Aphids, sowing cabbage and cauliflower at some distance from beds of other cultivated plants, such as swiss chard, spinach, zinnia, petunia or tobacco, that may be alternative hosts for one or other of the viruses [*cf. loc. cit.*], and destroying diseased plants, particularly in the seedbeds. Spraying with tobacco extract (1 : 500) and soap at weekly intervals keeps the plants free from serious Aphid infestation, but does not give complete protection against infection, since, as was shown by experiments, young seedlings can be infected by a single winged Aphid. It was found possible, however, to produce good marketable cabbages in October and November with only minor loss from disease or leaf-eating caterpillars if the tobacco spray was applied weekly with the addition of lead arsenate (3 lb. per 100 gals. wash) from very early in the season until the plants were hearting. Spraying cabbages in the fields may be too expensive for general practice, but spraying seed-beds is extremely important. Rapidly growing varieties were the least affected by mosaic, and it is doubtful if the larger varieties should be grown during the hot months in areas where crucifers have been cultivated for some years. A close season of three months every year, to allow Aphids infected with the mosaic virus to die off, is suggested.

VAN EMDEN (F. I.). **A Tachinid parasitic on** *Plutella maculipennis*, **Curt.**—*Bull. ent. Res.* **33** pt. 4 pp. 223–225, 1 fig. London, 1942.

The author describes the adults of both sexes of the Tachinid, *Cadurcia plutellae*, sp. n., reared from *Plutella maculipennis*, Curt., in Kenya Colony, and gives characters distinguishing it from the other species of the genus.

RAMCHANDRA RAO (Y.). **Some Results of Studies on the Desert Locust** (*Schistocerca gregaria*, **Forsk.**) **in India.**—*Bull. ent. Res.* **33** pt. 4 pp. 241–265, 8 refs. London, 1942.

This paper contains the most important of the results of the author's investigations on *Schistocerca gregaria*, Forsk., in India in 1931–39. To find the maximum number of generations possible in a year [*cf. R.A.E.*, A **24** 634], locusts were reared in outdoor cages in desert conditions in Mekran, but supplied with fresh food and wet sand. The durations of the stages of development at the various temperatures are shown in tables. At mean monthly temperatures of 28–30°C. [82·4–86°F.] sexual maturity was attained in 3–4 weeks, and the egg and nymphal stages lasted 14 and 31 days. Development was much slower in other seasons, and only three generations were as a rule produced in a year [*cf.* **26** 628], though four are theoretically possible if conditions are favourable in all the areas to which the locust migrates through the year. Observations on the effect of food [*cf.* **26** 628] showed that hopper development was most rapid on cabbage and sorghum seedlings, and that sexual maturation was accelerated by feeding on fresh *Heliotropium undulatum* (characteristic of the coastal "reks" of Mekran) and on sorghum and maize. This fact may be of importance in accelerating maturation and breeding on the coastal "reks" [*cf.* **22** 121] and on cultivated plots in the interior of Baluchistan.

The development of mauve, blue and pink areas at the base of the wings was experimentally shown to be caused by exposure of the wings to sunlight, and their presence indicates that a locust has undergone migratory flight.

As a result of mass biometrical studies, two new ratios are proposed for phase determination, *viz.* V/F (length of the elytron up to the tip of the vannal area over the femur), which can be used to determine the E/F (elytron over femur) ratio when the tip of the elytron is broken, E/F lying between V/F × 1·31 and V/F × 1·32, and C/O (maximum width of face in the genal region over its maximum width in the ocular region). Ratios of five kinds characteristic for the three phases are shown in a table. Although the extreme phases are quite distinct, the variable characters in phase *transiens* are not linked and occur independently ; E/F is the most significant ratio and should be used in preference to the others. To determine the ever-changing biometrical facies of a locust population in the field, the locusts were divided into the categories *solitaria*, *transiens* and *gregaria*, with E/F ratios of 2·05 or less, 2·06–2·15 and 2·16 or more, respectively, and also classified according to whether they had 6 or 7 eye-stripes. The percentages of individuals in a given population belonging to these different groups were then calculated, and the biometrical facies of the population expressed by the formula S : T : G : : (6) : (7), each category being preceded by the corresponding percentage.

The life-cycle and migrations of phase *solitaria* in India were studied by means of regional surveys, in which all areas in which this phase occurs were visited at least once in every 2 or 3 months, and by intensive continuous observations throughout the year at selected spots. Population densities per sq. mile were estimated by means of the formula 240L÷MD, in which M is the number of observers, D the distance they walk in miles, and L the number of locusts seen by each observer within a range of 11 ft. on each side of the line along which he walks. Although this method does not yield very accurate results, it provides estimates of population densities and demonstrates fluctuations in them. Densities of less than 10,000 individuals per sq. mile are of no importance, but higher figures indicate the possibility of concentrations in favourable localities.

The surveys carried out over a period of nine years have shown that the bionomics of phase *solitaria* are strikingly correlated with seasonal weather changes. The annual cycle, characterised by migrations between areas with winter, spring and summer rainfall [**26** 628], is described. The extent and intensity of breeding depends in every case on the amount and duration of rainfall. The periods of migration coincide with seasonal rises in temperature and falls in humidity, the autumn migration in the Sind-Rajputana desert occuring at a time when maximum day temperatures may be as high as 107°F. The easterly migrations in early summer are associated either with dry hot northerly and north-westerly winds, or with south-westerly winds ; the return autumn migration in a westerly direction is associated with dry north-easterly winds. On some occasions, flights of locusts were found to be connected with the passage of dust and thunder storms [*cf.* **28** 508], at the approach of which caged locusts became greatly excited. In addition to wind, the direction of flight is determined in the mountainous parts of Baluchistan by the orientation of the valleys. Overwintering by adults may occur not only in the Mekran, but also in other parts of Baluchistan and in the Sind-Rajputana desert. Although at altitudes of over 4,000 ft., mortality from frost is high, hoppers and adults survived a temperature of 17°F. and only succumbed to wet cold at 13°F.

Comparison of the annual cycle and migrations of phase *solitaria* with those of phase *gregaria* in 1926–31, which are briefly described [*cf.* **22** 121], show that there is a remarkable parallelism between them. However, swarms can move over greater distances, migrations of *solitaria* occurring between British and Iranian Mekran and the Rajputana desert, while swarms may fly north to the Himalayas, east to Assam, and south to Madras.

The discovery that phase *solitaria* can migrate over large distances, and that its population density in breeding areas is marked by continual fluctuations due not only to local breeding, but also to immigration and emigration, has modified the original conception of the origin of outbreaks by the building up of large populations within given outbreak areas. Such building up is now visualised as the result of breeding under conditions favouring concentrations in one or more areas that may be widely separated but are connected by seasonal migrations, and the way in which outbreaks are thus built up in India is described [*cf.* **29** 519].

WOMERSLEY (H.). **Studies in Australian Acarina. (2) Tyroglyphidae (s.l.).**—*Rec. S. Aust. Mus.* **6** no. 4 pp. 451–488, 21 figs. Adelaide, 1941. [Recd. 1943.]

Among the species dealt with is *Tyrophagus putrescentiae*, Schr. ; the author considers that *Acarus dimidiatus*, Herm., *Tyroglyphus longior*, Gerv., *T. infestans*, Berl., and *T. lintneri*, Osb., are all synonyms of it [*cf. R.A.E.*, A **31** 69].

TINDALE (N. B.). **Revision of the Ghost Moths (Lepidoptera Homoneura, Family Hepialidae). Part IV.**—*Rec. S. Aust. Mus.* **7** no. 1 pp. 15–45, 3 pls., 51 figs., 30 refs. Adelaide, 1941. [Recd. 1943.]

This paper is a continuation of the author's revision of the Australian Hepialids, but the scope of the study has been widened in view of the presence of related genera in other regions, and attention is devoted, among others, to several Asiatic genera. It is concluded that the genus *Phassus* should be restricted to a well-defined group of species associated with *P. argentiferus*, W k., and confined to Central America. The Old World species that have been included in it are referable to other genera, several of which are defined in this paper. A new genus, *Sahyadrassus*, is erected for *P. malabaricus*, Moore, which feeds on teak and is confined to the Western Ghats of India, and *P. damor*, Moore, *P. purpurescens*, Moore, and *P. signifer*, Wlk., are all referred to the genus *Endoclita*. Hitherto three species have been recorded as *P. signifer*. They are *E.* (*P.*) *undulifera*, Wlk., which has been reared from *Alnus nepalensis* in Sikkim and *Buettneria pilosa* and *Callicarpa arborea* in Burma ; *E.* (*P.*) *chalybeata*, Moore, which is of importance as a pest of young teak saplings, is the only species known to attack the wood of teak in Burma and Assam, and has also been reared from *Gmelina arborea* ; and *E. signifera*, which the author considers to be confined to Assam. Of seven new species of *Endoclita* described in this paper, food-plant records are given for *E. gmelina* and *E. buettneria*, which were reared from *G. arborea* and *B. pilosa*, respectively, in Burma.

BEESON (C. F. C.). **Ecological Aspects of Defoliation in Shisham Plantations.**—*Indian For. Rec.* (N.S. Ent.) **7** no. 1 pp. 1–8, 2 refs. Delhi, 1942.

The plantations of shisham (*Dalbergia sissoo*) established in the Punjab since 1913 are in semi-desert, to which the tree is not indigenous, and both it and the plants and insects that have invaded the afforested area are dependent on irrigation in the early stages of development. The local subsoil water-level is the most important factor influencing the liability of a plantation to defoliation by the Noctuid, *Plecoptera reflexa*, Gn. ; if the subsoil water is high enough, the trees come into full leaf early in spring, independently of rainfall or irrigation, mature their foliage quickly and normally escape serious damage because the proportion of soft expanding leaves in the total foliage is relatively small and the first-instar larvae cannot develop on mature leaves. In regions with inaccessible subsoil water, but with monsoon and winter rains sufficient to provide soil moisture, the trees come into leaf early and *Plecoptera* does not thrive. Rainfall appears to have no direct action on the development of infestations. Any measures that conserve soil moisture and advance leaf production in late-leafing areas reduce the general hazard for the whole plantation. Deep irrigation at intervals of 35–45 days is preferable to shallow irrigation at fortnightly intervals, as it induces the rapid formation of deep taproots, prolongs the growing season and does not result in flushes of new leaves that coincide with the emergence of each generation of the defoliator. Shisham should be grown only on soil that is suitable for it, as unhealthy trees are subject to attack and form foci from which outbreaks spread to more vigorous stands. Some form of soil cover should be grown to reduce the chances of wandering larvae regaining the trees, and to protect beneficial insects, birds and mammals and support species of insects that form their alternative food. Other desirable ecological conditions, including the presence of parasites and predators, follow the establishment of deep-rooted early flushing stands. Mechanical control measures, such as spraying or dusting, or banding the trees with adhesive and shaking them to dislodge the larvae, are expensive and impracticable over extensive areas.

MATHUR (R. N.). **On the Biology of the Parasites of the Shisham Defoliators in the Punjab Plantations.**—*Indian For. Rec.* (N.S. Ent.) **7** no. 1 pp. 9–65, 2 figs. Delhi, 1942.

The author gives notes, varying in detail with the importance of the species, on the biology, distribution and alternative hosts of 47 parasites and hyperparasites that were bred in 1938–40 from *Plecoptera reflexa*, Gn., *Dichomeris* *eridantis*, Meyr., or *Leucoptera sphenograpta*, Meyr., on shisham (*Dalbergia sissoo*) in the Punjab [*cf.* *R.A.E.*, A **29** 74]; the incidence of these moths and the amount of injury they cause to the tree are briefly discussed, and the local distribution of the parasites attacking each, and the percentage parasitism of larvae and pupae of *P. reflexa* and larvae of *D. eridantis* by different species in various localities and at different times of the year are shown in tables.

In addition to the liberations already noticed [*loc. cit.*], adults of *Microgaster plecopterae*, Wlkn., were released against *Plecoptera* at Miranpur, Arafwala and Dipalpur, and adults of *Disophrys sissoo*, Wlkn., *Euplectrus parvulus*, Ferrière, and *Podomyia setosa*, Dol., against *Plecoptera* and *Meteorus dichomeridis*, Wlkn., against *Dichomeris* at Miranpur in June and July 1939. Adults were noticed flying among the foliage on the day after release; a few recoveries of *D. sissoo*, *E. parvulus* and *P. setosa* were made by collecting the defoliators at random at the liberation points, and two cocoons of *Microgaster* were recovered at Miranpur in July 1939.

In experiments in 1938, the eggs of *Plecoptera reflexa* were readily parasitised by *Trichogramma minutum*, Riley, each yielding 2–3 adult parasites.

Hem Singh Pruthi & Mani (M. S.). **Distribution, Hosts and Habits of the Indian Serphoidea and Bethyloidea.**—*Mem. Indian Mus.* **13** pt. 4 pp. 405–444, 21 figs., 74 refs. Calcutta, 1942.

Lists are given of the Indian Scelionids, Calliceratids, Proctotrupids, Dryinids and Bethylids, with references to their original descriptions and notes on their bionomics and hosts. There is also a list of host insects showing which parasites attack them.

Gadd (C. H.). **Report of the Entomologist for 1941.**—*Bull. Tea Res. Inst. Ceylon* no. 23 pp. 43–51. Talawakelle, 1942.

Outbreaks of nettlegrubs [Limacodids] on tea were reported from only 11 estates in Ceylon in 1941 [*cf.* *R.A.E.*, A **30** 319]; a list is given of the species found. The Braconid parasite, *Macrocentrus homonae*, Nixon, was present on all estates from which reports of outbreaks of the tea tortrix [*Homona coffearia*, Nietn.] were received [*cf.* **30** 418]. Colonies of *Toxoptera aurantii*, Boy., on two tea seedlings growing under bell jars were almost completely destroyed by a species of *Empusa*, but though this fungus was also found on 18 of 72 colonies on 50 bushes in the field in October, it is unlikely to give such effective control under natural conditions. Larvae of *Stauropus alternus*, Wlk. [*cf.* **20** 498] appeared in rather large numbers on tea in the Passara district during February and March; 2 of 50 collected were parasitised by the Braconid, *Apanteles taprobanae*, Cam. (*stauropi*, Vier.), but the Tachinid, *Zenillia* (*Exorista*) *gnava*, Mg., was not found, and the chief natural means of control was a wilt disease. In the insectary, the egg, larval and pupal stages averaged 6–7, 37 and 12–13 days, respectively, males lived for 19 and females for 20 days, and the largest number of eggs deposited was 194.

The larvae of *Terias blanda silhetana*, Wallace, and *T. hecabe*, L., are common on *Albizzia*, but are usually fairly well controlled by the Chalcid, *Brachymeria megaspila*, Cam., and a Tachinid; the parasites were absent, however, in 1941, and considerable defoliation occurred, Seedlings may be killed by these Pierids, but older plants may be defoliated and yet recover. Infestation may occur at any time of year, but is usually commonest between October and January; the life-cycle lasts about a month. For control, young plants should be sprayed with 1 lb. soft soap in 6 gals. water or with 1 lb. lead arsenate and 1 lb. soft soap in 50 gals., or dusted with Paris green in sifted lime (1 : 8), and older trees should be lopped, the loppings being buried to destroy the larvae and pupae.

The larvae have occasionally been found feeding on tea, after they have fallen from the defoliated *Albizzia*, but young larvae did not survive when confined to tea.

Much of the information given on the shot-hole borer of tea [*Xyleborus fornicatus fornicatior*, Egg.] has already been noticed [*cf.* **30** 232, 509]. When castor (*Ricinus communis*) in the stage of development at which it is attacked by the castor beetle [*X. f. fornicatus*, Eichh.] was subjected to attack by *X. f. fornicatior*, 5 of 19 galleries dissected were found to contain all stages, showing that breeding occurs in this plant under suitable conditions. Branches of *Gliricidia sepium* that were broken by strong winds on two estates were found to have been attacked by the shot-hole borer; only young branches, 3–5 ft. long, were injured, and there was no evidence of breeding. Analysis of data on the breakage of tea branches, obtained in 1939–40, confirmed that attack by *X. f. fornicatior* on tea is slight during the first year after pruning [*cf.* **30** 509]; the average number of broken branches per bush during a two-year pruning cycle was 4·68 and the average diameter at the break 0·3 in. An attempt was made to interpret broken branches in terms of loss of crop by removing a given number of branches from bushes on an estate where the Scolytid does not occur, but the results obtained were so variable that it was concluded that though breakages must result in loss of crop, the accurate estimation of such loss is difficult.

Lever (R. J. A. W.). **Entomological Notes.**—*Agric. J. Fiji* **13** no. 2 pp. 48–49, 10 refs. Suva, 1942.

Throughout the Fiji Islands, the leaves of cultivated cucurbits are attacked by beetles of two or three species, of which *Aulacophora coffeae*, Hrnst., is the most important and *A. quadrimaculata*, F., less serious. *A. similis*, Ol., though present in Fiji, has not been reported as a pest there. Applications of a dust of pyrethrum in flour or wood ash (1 : 4) or a spray of 1 oz. calcium arsenate and 3 oz. lime in 4 gals. water were recommended for the control of an outbreak of *A. coffeae*, reported from Ovalau in April 1942. In the laboratory, the females deposited about 36 eggs at one time, usually on wet soil, but occasionally on pumpkin leaves. The eggs hatched in 14 days in April and May. The larvae mine into the stems at ground level and feed on the tissue of the stalks.

The dry-wood termite, *Kalotermes repandus*, Hill, which has been recorded from floor boards [*cf. R.A.E.*, A **29** 495], was found in living trunks of the mangrove, *Bruguiera gymnorrhiza*, in October 1941, and all castes, including winged forms, were observed in dead stems of the ornamental bush, *Acalypha wilkesiana*, in 1942. Since 1938, when it was found to cause yellowing of rice leaves [*cf.* **28** 323], *Sogata furcifera*, Horv., has been reported as a pest each year during March or April. There was a marked tendency for late-planted rice of one variety to be more severely attacked than that planted early or than two other varieties. One infestation was controlled by draining. Eggs were deposited between two leaf veins.

Moutia (A.). **Division of Entomology.**—*Rep. Dep. Agric. Mauritius 1941* pp. 14–21. Port Louis, 1942.

Clemora (*Phytalus*) *smithi*, Arr., is still the most important pest of sugar-cane in Mauritius, despite attempts in recent years to control it by means of imported parasites and predators. Of the many Scoliids introduced, only *Campsomeris phalerata*, Sauss., could be found in fairly large numbers in heavily infested areas in 1941; it appears to have displaced *C. pilosella*, Sauss. [*cf. R.A.E.*, A **28** 243], which in turn had displaced *C. coelebs*, Sichel [**24** 666, 667]. Attempts to establish *Pyrophorus luminosus*, Ill. [**26** 316] and *Bufo marinus* [**30** 394] are considered to have failed. The cessation of hand-collecting [**28** 243] has not been followed by increased infestation ; sporadic outbreaks, which, however, are generally accompanied by a satisfactory increase in parasite population, are thought to be inevitable.

More than 1½ millions of the imported egg-parasite, *Trichogramma evanescens*, Westw., were liberated against the sugar-cane moth-borer, *Proceras* (*Diatraea*) [*sacchariphagus*, Bojer] between January [*cf.* **30** 395] and July over an area of 50 acres, but none of the 35,120 eggs of the moth subsequently collected from this area was parasitised and there was no significant difference between the degrees of infestation in the experimental and control fields. Extensive liberations of the local egg-parasite, *T. australicum*, Gir., were begun during the last five months of 1941. The mean percentage of egg-batches parasitised by this species between March and December in the field was found to be 1·81 and that between May and July 3·5. *Xanthopimpla stemmator*, Thnb., was the only introduced parasite [*cf.* **30** 474] recovered in the field during the year ; it was scarce, and no large-scale distributions could be made. A total of 7,678,000 eggs of *Corcyra* [*cephalonica*, Staint.] were obtained for use in rearing *Trichogramma* spp. [*cf.* **26** 176]. The mean number of eggs laid by a single female of this moth was 88, and females represented 29 per cent. of the total population. At a mean temperature of 28°C. [82·4°F.] and a mean relative humidity of 70 per cent., the life-cycle lasted 58 and 66 days when the larvae were reared on maize and on wheat flour, respectively. The sensitiveness of *T. australicum* to low temperatures is a disadvantage for mass-rearing ; emergence was reduced by 95 per cent. when eggs parasitised by it were kept at 4°C. [39·2°F.]. Its life-cycle lasted 8 days in summer and 14 in winter, when the mean temperatures were 24 and 18°C. [75·2 and 64·4°F.], respectively. A strain of *Trichogramma* obtained from eggs of *Achaea* readily parasitised those of *Proceras* in the laboratory. Experiments showed that eggs of *Corcyra* that have been kept for more than a week in a refrigerator are unsuitable for use in rearing *T. evanescens* ; parasitism was reduced from 76 per cent. after 7 days at 0–3·3°C. [32–37·94°F.] to 7 per cent. after 28, and unparasitised eggs did not hatch after exposures of 14 or more days. The life-cycle of *P. sacchariphagus* lasted 73–90 days in field and laboratory investigations. Three periods of attack, probably due to three generations, occurred on first-year cane during the year.

An outbreak of *Chionaspis* (*Aulacaspis*) *tegalensis*, Zehnt., occurred in September on sugar-cane on several estates in one district, and infestation as high as 25 per cent. was recorded in one instance. In some cases, the reduction in yield was estimated at 5–10 tons per acre, and there was a marked reduction in sucrose content. It is proposed to rear and liberate the predacious Coccinellids, *Chilocorus politus*, Muls., and *C. nigritus*, F., to combat this Coccid. These Coccinellids continued to reduce *Aspidiotus destructor*, Sign., on coconut [*cf.* **29** 610] to such an extent that at times supplies of the Coccid for rearing the predators were difficult to obtain, and the systematic planting of coconut is again recommended.

Maize seeds on cobs that are not already infested by insects can be protected for 4–5 months from infestation during storage by soaking the dried cobs for 10–12 minutes in an emulsion of Diesel oil and clay (1 : 1) diluted to contain 10 per cent. oil ; about 50 gals. of the diluted emulsion is required to treat 1 ton of cobs. This method is not effective if the cobs are not sufficiently dried or the initial atmospheric humidity is high enough to enable the moisture content of the seeds to exceed 13 per cent. An emulsion of Diesel oil and clay containing 1 per cent. actual oil was again of use against the initial stages of outbreaks of *Agromyza* (*Melanagromyza*) *phaseoli*, Coq., on beans [**30** 395]. This fly was found for the first time breeding on *Solanum nigrum*, and beans should therefore not be grown near this plant. Larvae of *Contarinia* sp. fed on the flowers of *Citrus*, causing them to drop prematurely, and adults tentatively determined as *Prays citri*, Millière, and *Chlorocystis* sp. were reared from larvae also taken in the flowers. A species of *Agromyza* was recorded for the first time mining the leaves of maize, and *Trichoptilus wahlbergi*, Zell., and a leaf-miner, thought to be a species of *Elachista*, were of minor importance on sweet potato.

The mixture recommended against termites [**29** 610] was completely effective against *Eutermes* (*Nasutitermes*) *voeltzkowi*, Wasm. Dry-wood termites, of which the most important is *Kalotermes* (*Cryptotermes*) *pallidus*, Ramb., are more difficult to control, owing to the absence of runways and the occurrence of isolated colonies in infested wood.

FLANDERS (S. E.). **Oösorption and Ovulation in Relation to Oviposition in the parasitic Hymenoptera.**—*Ann. ent. Soc. Amer.* **35** no. 3 pp. 251–266, 11 figs., 20 refs. Columbus, Ohio, 1942.

The following is the author's summary. In the parasitic Hymenoptera, the occurrence of oösorption prior to ovulation [*cf. R.A.E.*, A **31** 19] and the storing of ripe eggs after ovulation are adaptations for maintaining the reproductive capacity of the species when environmental conditions are unfavourable for oviposition. Eggs may be stored for periods longer than that necessary for incubation only when they are hydropic, that is, when they lack nutritive substances necessary for embryonic development. In a certain species of *Apanteles*, the ovary and its oviduct are modified for storing its full quota of eggs.

The fact that the ripe eggs of certain species of Encyrtids possess structures which are not absorbed provided proof of the synchronous nature of the oögenic-oösorptive processes that occur in many Hymenoptera. Oösorption was found to occur only when ovulation was inhibited. When there is a sequence of developing oöcytes in the ovarioles the leading or ripe egg is always newly formed, the preceding egg having disappeared, either through oösorption or ovulation. Oösorption on one hand and the storing of ripe eggs on the other are adaptations permitting the restraint in oviposition which is so essential to host selection. In the Lecaniine scale parasite, *Metaphycus helvolus*, Comp., the adult female of which habitually feeds on its host, the resumption of oögenesis after phasic castration is solely dependent on host-feeding.

NICOL (H.). **Biological Control of Insects.**—*Pelican Book* no. A 113, 174 pp., portr., 8 pls., 11 figs., many refs. Harmondsworth, Mddx., Penguin Books Ltd., 1943. Price 9*d*.

This is a popular account of the various ways in which natural enemies have been used for the control of insect pests and of the investigations that were necessary before satisfactory results were obtained. Much of it is devoted to accounts of searches for and the liberation of parasites and insect and other predators, the examples being selected to illustrate the various techniques adopted in response to different problems, but other biological methods, such as the use of disease organisms, trap-crops and cultural measures that affect the interaction of the life-cycles of the pest and its food-plant or that alter the physical environment of the pest are also discussed. Information is given on the ways in which insects are reared on a large scale for liberation, with some of the difficulties that must be overcome and the precautions that must be taken, and other chapters deal briefly with the structure and habits of insects, parasitism, and the influence exerted on biological control by the occurrence of different races among individual insect species. The complexity of the natural balance between a species and its environment and the consequences that may ensue when it is disturbed are discussed with reference to biological control, and a further chapter is devoted to the limitations to this method of control. Accounts are also given of the control of noxious weeds in Australia, South Africa and elsewhere by means of insects.

BONDAR (G.). **Notas entomológicas da Baía. X.**—*Rev. Ent.* **13** fasc. 3 pp. 225–274, 23 figs., 20 refs. Rio de Janeiro, 1942.

In this part of a series on insects in Bahia [*cf. R.A.E.*, A **31** 119], it is recorded that *Alphitobius laevigatus*, F. (*piceus*, Ol.), the adult of which is described, caused serious injury to stored seeds of castor (*Ricinus communis*). Cacao beans and kernels of the licuri palm (*Cocos coronata*) were preferred to castor seeds in the laboratory. Stored copra and kernels of *C. coronata* and cake pressed from both were attacked by *A. laevigatus*, *Necrobia rufipes*, DeG., and *Tenebroides mauritanicus*, L.

In a section on weevils that bore in the wood of guava (*Psidium guayava*), it is stated that *Cratosomus impluviatus*, Germ., oviposits in the trunk and branches and that the larvae bore upwards in the wood in spiral fashion, causing deformation. *C. undabundus*, Gylh., bores downwards from the branches to the trunk [*cf.* **13** 492]. This weevil has been considered to be a synonym of *C. tuberculatus*, Perty, but the author describes characters distinguishing the adults and states that *C. undabundus* is restricted to Myrtaceae, whereas *C. tuberculatus* breeds in Lauraceae and is a common pest of bay (*Laurus nobilis*) in São Paulo. Their habits are similar. A weevil that is a serious pest of guava in the State of Espirito Santo is described as *Elytrocoptus landeiroi*, sp. n. The larva feeds beneath the bark of trunk and branches, destroying the cambium layer and causing deformation and sometimes death of the tree, and bores into the wood to pupate. Development lasts several months. Guava and *Psidium araca* already dying as a result of other injury are attacked by *Laemosaccus ebenus*, Pasc.; the larvae develop in the trunk and branches, and the adults feed on the young leaves.

The rest of the paper comprises descriptions of new genera and species of Barine weevils.

CALLAN (E. McC.). **Notes on Cassava Weevil-borers of the Genus** *Coelosternus* **(Col. Curculionidae).**—*Rev. Ent.* **13** fasc. 3 pp. 304–308, 9 refs. Rio de Janeiro, 1942.

The author reviews records of weevils of the genus *Coelosternus* on cassava (*Manihot utilissima*) in tropical America and briefly describes the adults, larvae and pupae of *C. alternans*, Boh., and *C. tardipes*, Boh., which have recently been found attacking it in Trinidad, the former being the commoner. The larvae of both bore in the stem, weakening the plant and rendering it liable to break. The roots are not attacked. The larvae of *C. alternans* bore through the wood to the central pith, and small particles of wood with the sticky exudate from the stem are ejected on to the branches or ground. Pupation occurs in a chamber at the end of the mine, and the newly emerged adult remains in the pupal chamber for some days. The bionomics of *C. tardipes* appear to be similar. No alternative food-plants or natural enemies of these weevils are known. Infested parts of the plants should be removed and destroyed, and the fields should be cleaned up after the harvest. Rotation of crops would be beneficial.

DETHIER (V. G.). **Hesperiidae affecting Sugar Cane in Cuba.**—*Mém. Soc. cubana Hist. nat.* **16** no. 2 pp. 167–176, 1 pl., 9 refs. Havana, 1942.

A list is given of 10 Cuban Hesperiids that fed on the leaves of sugar-cane in the laboratory, together with descriptions of the immature stages of *Lerodea tripunctus*, H.-S., *Panoquina* (*Prenes*) *nyctelius coscinia*, H.-S., *P.* (*P.*) *nero sylvicola*, H.-S., and *Perichares coridon*, F., which are the only ones that do so commonly in the field. The first two were especially numerous during the summers of 1939 and 1940, though they are usually controlled by natural enemies. Keys to the larvae and pupae of these four species are included, and characters distinguishing the larvae are briefly discussed.

The eggs of *L. tripunctus* are laid singly on the upper surface of the leaves of sugar-cane and other grasses and hatch in 2–4 days. The larva wanders for a while and then forms a shelter by turning back the tip of a leaf and begins to feed. A new shelter is made in each instar. There are five instars, each lasting 4–7 days. Pupation takes place along the midrib, the edges of the leaf being slightly drawn together, and the adult emerges 8 days later. The cane plants attacked are mainly those at the edges of the fields, and grass is preferred for oviposition when growing in lush clumps in the shade. The larvae are attacked by spiders, the Pentatomid, *Mormidea pictiventris*, Stål, and Tachinid parasites. *Panoquina nyctelius coscinia*, which has been recorded as a minor pest of sugar-cane in Porto Rico and the Dominican Republic, also lays its eggs singly on the upper surface of grass and cane leaves. The larvae, which hatch in 4 days, pass through 7 instars in Cuba, each of 4–7 days. The pupal stage lasts 9 days. This species is less common and the larvae are attacked by many natural enemies, including undetermined species of *Hemiteles*, *Microgaster* and *Cardiochiles*, *Mormidea pictiventris*, ants, spiders, lizards, frogs and a bacterial wilt. The bionomics of *P. nero sylvicola*, which is the commonest, are similar. The young larvae prefer grass to cane, but as they grow older show no preference. They are attacked by a Chalcid, *M. pictiventris*, lizards, spiders, frogs and a bacterial wilt. The larvae of *Perichares coridon* occur only in small numbers, and no parasitised individuals were obtained.

TOPPER (B. F.). **Tomato Cultivation on the College Farm.**—*Trop. Agriculture* **19** no. 9 pp. 180–182, 8 refs. Trinidad, 1942.

In a brief section on the insect pests and diseases of tomato in Trinidad, mole-crickets and flea-beetles are stated to be the most injurious insects in nurseries; in 1934, flea-beetles were controlled by a dust of Paris green and flour (1 : 32). Females of *Contarinia lycopersici*, Felt, oviposit in the unopened buds of plants in the field, and feeding by the developing larvae causes the buds to drop. An experiment in 1942 indicated that these larvae are not responsible for a well-defined type of damage, known to occur early in the development of the fruit, as a result of which characteristic deep wounds occur on the mature fruit; all buds known to be infested withered and fell, and the rest gave rise to undamaged fruit. Larvae of *Prodenia* and *Heliothis* and a small undetermined web-spinning larva, all of which mine the fruit, and larvae of *Protoparce* sp., which defoliate the plants, are generally controlled by hand-collecting. Other pests of field tomatos are Lamiids of the genus *Alcidion*, which kill the plants by tunnelling in the stems, Coreids, which attack the fruit, mole-crickets and flea-beetles.

PICKLES (A.). **Plant Pests.**—*Adm. Rep. Dir. Agric. Trin. Tob. 1941* p. 11. Trinidad, 1942.

Severe and widespread outbreaks of the sugar-cane froghopper [*Tomaspis saccharina*, Dist.] continued in Trinidad in 1941 [*cf. R.A.E.*, A **30** 495], when canes over about 6,000 acres were severely blighted. Pyrethrum dust was again used against this Cercopid on one estate. Experiments showed that individuals stupefied by pyrethrum in the field may recover after a few hours, but the proportion that does so varies, and when the dust is properly applied, satisfactory control is given. Severe infestation is capable of causing appreciable injury to most varieties of sugar-cane, including those that appear to possess some measure of resistance. The most important factor determining resistance is failure to produce secondary blight symptoms, and this property is particularly marked in the variety PR.803. Lepidopterous larvae that attack the leaves were again prevalent and caused considerable injury; *Laphygma frugiperda*, S. & A., destroyed young plant canes, and ratoon canes were damaged by *Mocis* (*Remigia*) *repanda*, F.

Oil sprays applied experimentally were again successful in controlling Coccids on *Citrus* [*loc. cit.*]. In an area sprayed in 1940 for the control of *Chrysomphalus ficus*, Ashm., infestation by Coccids was, in general, light in 1941, but trees on which road dust settled during the dry season were infested by *Selenaspidus articulatus*, Morg.

In experiments on measures against *Blissus insularis*, Barber, which again caused severe damage to lawns, Cyanogas calcium cyanide sprinkled very thinly over the infested area and brushed vigorously with a hard broom gave effective control without injuring the grass.

FENNAH (R. G.). *Citrus* **Pests of St. Vincent.**—*Rep. agric. Dep. St Vincent 1941* p. 9. Kingstown, St. Vincent, 1942.

An inspection of *Citrus* in St. Vincent between 17th August and 14th September 1941 showed that the most serious pests were Coccids, chiefly *Coccus viridis*, Green, *Lepidosaphes beckii*, Newm., and *Prontaspis* (*Chionaspis*) *citri*, Comst., which were widely distributed, the first two species on all types of *Citrus* and the last on orange. At Kingstown, *Orthezia praelonga*, Dougl., was common on grapefruit, *Selenaspidus articulatus*, Morg., was less abundant, and large numbers of the Coccinellid, *Pentilia castanea*, Muls., were preying on the Coccids. At Three Rivers Settlement, *Icerya montserratensis*, Ril. & How., was taken near the forest.

Damage by the larvae of *Diaprepes excavatus*, Rosensch., and what was probably a variety of *D. abbreviatus*, L., was slight, though scarred roots were seen in Kingstown. At Three Rivers Settlement, near the remains of former forest, tangerine orange trees had been almost destroyed by the boring of larvae of *Cryptorrhynchus corticalis*, Boh., in the trunks and branches. The adult of this weevil shelters in the entrance of an old larval burrow during the day; eggs are laid near the burrows of earlier generations, and the larvae bore into the wood for a short distance. Twigs and branches above close groups of such tunnels were usually dead or moribund. Lime trees and other varieties of orange nearby were undamaged. Since this weevil is typically a forest insect, attacks will probably be confined to plantations that border on forest.

PIDDUCK (H. B.). **Annual Report of the Agricultural Department, Dominica, 1941.** Fol. 4 pp., 1 ref. Dominica, 1942.

Examples of the predacious Histerid, *Lioderma quadridentatum*, F., received from the Imperial College of Tropical Agriculture, have been released for the control of *Cosmopolites sordidus*, Germ., on banana.

FLETCHER (F. W.) & KENAGA (E. E.). **Mothproofing Tests.**—*Soap* **18** no. 8. pp. 95–99, 1 graph, 3 refs. New York, N.Y., 1942.

An account is given of a co-operative research programme instituted in the United States to standardise a procedure for testing repellents for insects that attack fabrics. The test insect was the black carpet beetle, *Attagenus piceus*, Ol., and a quantitative test employing the weight of the frass as a measure of the resistance of fabrics to insect pests was used as a starting point for the testing programme. Specifications of the wool cloth selected as the standard test fabric are given, and the type of cage recommended is described. It was found that four batches of 10 larvae each weighing 4·5–6·5 mg. gave satisfactory results, and that though the size of the cloth specimens under test had no appreciable effect on feeding, one containing 2 sq. ins. cloth was the most desirable for other reasons. During a test of four weeks, 63–83 per cent. of the larvae were under the untreated cloth, 12–15 per cent. on it and 4–25 per cent. off it; the numbers of larvae off and under a specimen of cloth varied inversely and directly, respectively, with its size, but the number on the cloth was not related to size. Measurement of the weight of frass was compared with measurement of the loss of weight of the fabric for evaluating repellents. The former method is relatively accurate, since it is unaffected by changes of humidity, but is applicable only to larvae of *A. piceus*. The latter can be used in tests against all types of fabric pests, but is greatly affected by humidity changes. Comparison of the damage caused by larvae at the end of two and four weeks showed that approximately 60 per cent. of the feeding on untreated cloth and 90 per cent. of that on cloth impregnated with a repellent had taken place by the end of two weeks, but mortality counts showed that only 20 per cent. of the larvae on treated samples were dead at the end of two weeks as compared with 80 per cent. after four weeks. If, therefore, only the prevention of feeding is to be investigated, the two-week period is sufficient, but if the complete action of a toxic agent is to be tested, at least four weeks are necessary. Tests employing larvae without a cloth specimen established that an average of 1·6 mg. frass is produced in four weeks by ten starved larvae.

Comparative values are given for visual observation, measurement of frass weight and measurement of loss of fabric weight in determining the resistance of fabric to *A. piceus*. In general, the three methods give similar results. It was found that the weight of cloth lost was about twice the weight of frass produced.

CAMPAU (E. J.), WILSON (H. F.) & JANES (R. L.). **Increased Toxicity with Rotenone Dusts.**—*Soap* **18** no. 8 pp. 100–101, 103. New York, N.Y., 1942.

Details are given in tables of the results obtained with dusts of cubé and pyrophyllite (Pyrax) containing 0·1 per cent. rotenone in which a large variety of adjuvants were incorporated at the rate of 2 per cent., with and without the addition of 2 per cent. lubricating oil, tested against the pea Aphid [*Macrosiphum onobrychis*, Boy.] in the greenhouse. When the dusts contained oil, complete mortality was obtained in 72 hours with a number of proprietary adjuvants, including glyceryl oleate, in single tests and with propylene laurate in two of three tests. None of the dusts without oil killed all the Aphids, the average percentage being approximately 90 and less than 50 for dusts with and without oil, respectively. A complex sodium borophosphate was the only adjuvant tested that gave notably better results without oil than with it (75 and 48 per cent. mortality). In dusts containing only 0·05 per cent. rotenone, propylene laurate with oil gave complete mortality in one of four tests, and none of the others gave complete control. The average mortality percentages obtained when 4 and 2 per cent. oil were added to dusts containing 0·05 per cent. rotenone and no adjuvant were 91 and 18, respectively, and the authors consider that field tests should be carried out to determine whether higher concentrations of oil will make it possible to use low concentrations of rotenone during the war. No plant injury due to these dusts was observed either in the greenhouse or in the field.

Samples of rotenone dusts containing oil that had deteriorated owing to keeping appeared to regain their original toxicity when reconditioned with 2 per cent. oil.

ROARK (R. C.). **Insecticides : present Demand and long-term Outlook.**—*Oil Paint Drug Rep.* July 20th 1942, repr. 4 pp. New York, N.Y., 1942.

ROARK (R. C.). **Insecticides, Fungicides, and Hormone Sprays.**—*Industr. Engng Chem.* Industr. Edn. **34** no. 4 p. 489, 1 fig. Easton, Pa., 1942.

In the first of these papers, the author shows that the raw materials from which insecticides are manufactured and the plants from which they are extracted occur in many of the American republics, none of which produces all its requirements, and that the free interchange of raw materials is necessary for successful protection against injurious insects, which are estimated to cause damage to the extent of at least 2,000 million dollars a year in the United States. A list is given of many of the materials used in the control of injurious insects, fungi, bacteria and rodents and the quantities of some of the most important used in the United States in 1941 and of lead arsenate, nicotine sulphate and copper sulphate used on different crops in the same year are shown in tables. The amounts used (several hundred millions of pounds) are very small in comparison with the potential use, and in spite of the introduction of new materials, the consumption of the insecticides now known is bound to increase considerably. Examples are given of plants containing toxic principles that will grow in different parts of America, and the synthesis and testing of organic compounds as insecticides is discussed, phenothiazine, xanthone and phthalonitrile being cited as promising materials developed in this way.

In the second paper, a shorter account is given of the quantities of insecticides used in the United States and the need for developing new ones and improving those now used. The use of synergists to increase the toxicity of certain insecticides is a very promising development.

SMITH (C. M.) & GOODHUE (L. D.). **Particle Size in Relation to Insecticide Efficiency.**—*Industr. Engng Chem.* Industr. Edn. **34** no. 4 pp. 490–493, 4 figs., 17 refs. Easton, Pa., 1942.

The authors review accounts of experiments with dusts and sprays containing solid particles of different degrees of fineness and with oil emulsions and atomised oil with droplets of various sizes, from the results of which they conclude that, in general, fine subdivision of a solid insecticide is advantageous and that a correlation between droplet size and effectiveness in an emulsion is apparently the result rather than the cause of desirable qualities, quick-breaking emulsions, which contain larger globules, being probably more suitable as insecticides than more stable ones, whereas, when oils are atomised, their effectiveness depends on the droplets being 1–10 microns in diameter. A section on work that has been carried out with aerosols and methods of stabilising them is appended, and it is stated that tests with more than 150 organic compounds have shown that 3-chloroacenaphthene, 2-chlorofluorene, 3-chlorodibenzofuran, pentachlorophenol, phthalonitrile and xanthone are good fumigants when applied in this way.

HALLER (H. L.), GOODHUE (L. D.) & JONES (H. A.). **The Constituents of Derris and other Rotenone-bearing Plants.**—*Chem. Rev.* **30** no. 1 pp. 33–48, 77 refs. New York, N.Y., 1942.

Since extracts of the roots of *Derris*, *Lonchocarpus*, *Tephrosia*, *Mundulea* and other plants that contain rotenone also contain a number of related compounds, some of which are of insecticidal value, the molecular structure and chemical reactions of rotenone, deguelin, tephrosin, toxicarol, sumatrol, malaccol, elliptone and other constituents of these plants are reviewed. A table, based on experiments by various workers, shows the relative toxicity to insects of rotenone and optically active and inactive forms of some of these compounds and others derived from them.

HALLER (H. L.). **The Search for new Insecticides.**—*J. chem. Educ.* **19** no. 7 pp. 315–321, 5 figs., 61 refs. Easton, Pa., 1942.

The author reviews the development of the use of inorganic and organic chemicals against destructive insects and discusses the constituents that are responsible for the toxicity of plant insecticides in commercial use and the possibility of producing similar compounds synthetically. Brief accounts, based on the literature, are given of the chemistry of nicotine and related compounds, the pyrethrins, rotenone and related compounds [*cf.* preceding abstract], the alkaloids of hellebore (*Veratrum* spp.) and quassia.

VANCE (A. M.). **Studies on the Prevalence of the European Corn Borer in the East North Central States.**—*Circ. U. S. Dep. Agric.* no. 649, 23 pp., 3 figs., 16 refs. Washington, D.C., 1942.

The following is based on the author's summary. After it was first observed in Ohio and Michigan in 1921, *Pyrausta nubilalis*, Hb., spread in the north-eastern United States until, by 1939, it occurred over practically the whole of Ohio, much of Michigan, the north-eastern half of Indiana, the counties near Lake Michigan in Wisconsin, five counties in north-eastern Illinois and four in northern Kentucky. Its annual abundance on maize in autumn in comparable territory in Ohio, Michigan and Indiana in 1934–39 increased from an average of 12·6 larvae per 100 plants in 1934 to 111·2 per 100 in 1939. In 18 counties of Ohio and Michigan extending from the western end of Lake Erie, the general trend of populations from 1927 to 1939 was upward, with an increase from 21·3 larvae per 100 plants in 1927 to 126·5 in 1939. Significant decreases in abundance occurred in 1930 and 1934, and considerable increases in 1931 and in each year from 1935 to 1938; the population remained at about the same level in 1939 as in 1938. Infestation in early sweet maize west of Toledo, Ohio, increased from 1934 to 1938, when an average of 17·5 larvae per plant occurred in this crop; in 1939 the number was practically halved.

There was a tendency for certain individuals to produce two generations a year in 1936–39 in parts of Ohio, Michigan and Indiana, although the aggregate number of second-generation larvae entering hibernation each autumn constituted only a small proportion of the total population [*cf. R.A.E.*, A **27** 414, etc.]. Pupation of the first generation in mid-summer was most pronounced in early sweet maize near the western end of Lake Erie in Ohio and in several of the south-eastern counties in the infested area of Indiana. Attempts to associate abundance with weather, based on data obtained in Ohio and Michigan in 1927–39, were less successful than had been anticipated, but it was shown that extreme drought conditions caused significant decreases in population. Although unusual dryness in any or all of the months of May, June and July was considered adverse to the insect, it is probable that drought in July was most detrimental to it. Mortality of the larvae in winter, as it occurs within a given environment, is not a factor that can explain seasonal fluctuations of *P. nubilalis*. In very hot, dry summers, an appreciable mortality may occur among the pupae, but, in general, the egg stage and the period of establishment of the first and second instars in the maize plant constitute two of the most critical phases in the life-history.

Detailed observations on eggs at several points in north-western Ohio in 1934–36 showed that less than 1 per cent. were infertile; that relatively few were desiccated, the maximum being 5·7 per cent. at Toledo in 1934; that parasitism by *Trichogramma* was negligible; that destruction by predators ranged from 0·5 to 17·4 per cent., depending on season and locality; and that up to 12·7 per cent. of the eggs were dislodged in some unknown manner. In a given year and locality, 53·2–95·4 per cent. of the eggs hatched normally. In a locality west of Toledo, in which a considerable amount of sweet maize is grown, the average peak of oviposition for the period 1927–39 occurred between 8th and 12th July. Oviposition was latest in 1928, when 61 per cent. of the eggs were laid between 13th and 17th July, and earliest in 1938 and 1939, when 60 and 41 per cent., respectively, were laid between 23rd and 27th June, possibly owing to the influence of the increasing tendency to produce a second generation. The average number of eggs per mass during 1930–39 was 16·6. In early maize, grown near Toledo, relatively light oviposition in 1934, a drought year, was followed by increased oviposition in each of the succeeding four years; in 1939 oviposition was slightly less than in 1938. Survival from the deposition of eggs to the establishment of young larvae in early maize in this locality averaged about 24 per cent. in 1934–38.

WEBSTER (J. E.) & HELLER (V. G.). **The chemical Composition of Atlas and Dwarf Yellow Milo Plants in Relation to Chinch Bug Resistance.**—*Tech. Bull. Okla. agric. Exp. Sta.* no. 12, 29 pp., 3 figs., 21 refs. Stillwater, Okla., 1942.

The following is based on the authors' summary of this account of experiments carried out in Oklahoma in 1935–40. Chemical analyses of Atlas and Dwarf Yellow Milo sorghums, which are resistant and susceptible, respectively, to injury by the chinch bug [*Blissus leucopterus*, Say], were made at various stages of growth up to the heading stage, to discover whether any of the components vary in a manner that can be correlated with resistance or susceptibility. The content of solids in the juice, though generally higher in Milo plants, did not appear to differ significantly, but Milo plants were consistently higher in ash content. Conductivity studies indicated little variation between the varieties. Acidity measurements did not show significant differences, and astringency values, including tannins, on the basis of the amounts present, do not seem to explain any of the known differences in resistance. Sugars in both varieties increased progressively at least until heading time, and Atlas, though known as a sweet sorghum, invariably contained less. Moreover, Atlas rarely contained any appreciable amounts of sucrose, whereas Milo always had some, and generally large amounts. The percentage of sucrose in Milo was always much greater in the late afternoon than in the morning, and the difference between the two varieties at this time of day seems fundamental and more noteworthy than any other found.

Marked differences were found in the total nitrogen content of the plants and juices. Atlas normally showed a decreasing content with growth, and Milo an increasing one. Analyses for chlorides indicated that the higher values usually found for Milo may be significant. Only a few enzyme analyses are recorded, but these, together with unpublished data, fail to show any significant correlation between resistance and the catalase, oxidase or peroxidase activity. Determinations of phosphorus, potassium and calcium in one set of samples showed that Milo plants were generally richer in all. The hydrocyanic acid content of the two varieties was generally alike, and this, together with other observations, seems to exclude this compound from consideration in explaining resistance.

Separate analyses of leaves and stalks failed to yield any significant results.

FENTON (F. A.) & CHESTER (K. S.). **Protecting Cotton from Insects and Plant Diseases.**—*Circ. Okla. agric. Exp. Sta.* no. 96, 32 pp., 13 figs., 1 ref. Stillwater, Okla., 1942.

This circular contains an account of the bionomics of the principal insect pests of cotton in Oklahoma, the damage they cause and approved methods of control, with similar information on diseases.

Anthonomus grandis, Boh., is most injurious in the south-eastern counties, where the winters are mild, abundant woodland provides protection during winter and rain is usually frequent during the growing season, but it occasionally causes severe losses over a considerable part of the cotton area when climatic conditions become favourable. There are two complete generations and a partial third and fourth in the year. Cotton should be planted early, as the numbers of weevils increase greatly as the season progresses, and a dust of undiluted calcium arsenate should be applied to productive fields when 10 per cent. of the squares are infested and again 5 and 10 days later. Subsequent applications may be needed if the infestation again increases to dangerous proportions. The dust should be applied on a calm day at the rate of 4 lb. per acre on young cotton and at 5–7 lb. per acre on larger plants, and the treatment should be repeated if rain falls within 24 hours. Heavy infestations by *Aphis gossypii*, Glov., which result from excessive dusting with calcium arsenate against *Anthonomus* in some States, have been recorded only twice in Oklahoma. The plants should be treated with a 3 per cent. nicotine dust at the rate of 8–14 lb. per acre for the control of the Aphid, and the dust should be applied on a calm day when the temperature is at least 70°F., as the use of a cloth trailer to confine the fumes has not given uniform success.

Psallus seriatus, Reut., which migrates to cotton from wild food-plants [*cf. R.A.E.*, A **30** 117], destroys the squares soon after they appear. In the south-west of the State the cotton may be infested from July until the end of the growing season, but in the east attack may begin earlier and cease in time to allow the plants to set a late crop of bolls. As this is likely to be damaged by *Anthonomus*, attempts should be made to control the fleahopper with applications of dusting sulphur, of which at least 93 per cent. should pass through a 325-mesh screen, begun when 20 fleahoppers are found per 100 terminals or when the condition of the plants shows that they are present in injurious numbers. *Alabama argillacea*, Hb., migrates from further south into southern Oklahoma in late August and reaches the northern cotton-growing areas in September or October. In years in which cotton is late and infestation early, severe damage is caused by the stripping of the leaves before the bolls have matured or by staining of the lint after rain if much cotton is open, but if many bolls are mature but not open, defoliation may be beneficial, by allowing the sun to penetrate to the bolls, causing them to open earlier and checking boll rots ; furthermore, heavy infestation by *Alabama* prevents further production of fruits, and so causes starvation of *Anthonomus*, which is less able to survive the winter. Dusting with undiluted calcium arsenate, preferably when the larvae are small, gives effective control. The larvae of *Heliothis armigera*, Hb., which may seriously reduce yields by hollowing out the green bolls and also attack squares and blooms, can be controlled by applications of calcium arsenate at the rate of 10 lb. per acre at five-day intervals, made with the nozzle of the dusting machine practically touching each row of cotton treated. The types of dusting machines recommended are described, and a key is given for identifying the pests and diseases by the damage they cause.

MARSHALL (G. E.), CHILDERS (N. F.) & BRODY (H. W.). **The Effects of Leafhopper Feeding Injury on apparent Photosynthesis and Transpiration of Apple Leaves.**—*J. agric. Res.* **65** no. 6 pp. 265–281, 5 figs., 14 refs. Washington, D.C., 1942.

Much of the information in this report of laboratory experiments in Ohio with Jassids collected in an apple orchard in Indiana to determine the effect of various degrees of leafhopper feeding injury on apple leaves has been noticed from a less detailed account [*cf. R.A.E.*, A **30** 536].

The following is based on the authors' summary. Injury caused to the leaves by several species of *Typhlocyba* and *Erythroneura* and by *Empoasca fabae*, Harr., was accompanied by a more or less marked reduction in apparent photosynthesis and transpiration ; photosynthesis was usually affected sooner and to a greater extent than transpiration. Feeding by *E. fabae*, which is among the least common of the species that occur in the orchard, interfered with leaf metabolism more severely than feeding by the same number of individuals of the other species. Microscopic examination of cross sections of injured leaves showed that *Typhlocyba* and *Erythroneura* removed the contents of the cells in the palisade layers, while the spongy mesophyll cells were not significantly affected unless the leaf had been severely injured. Since the data show that apparent photosynthesis and transpiration of apple leaves may be reduced early in the growing season when the leafhopper population is moderately low, and that this permanently impairs the capacity of the injured leaves to function normally, early control of the insects is important.

Haller (M. H.), Cassil (C. C.), Gould (E.) & Schrader (A. L.). **Further Studies on the Removal of Spray Residues from eastern-grown Apples.**—*Tech. Bull. U. S. Dep. Agric.* no. 828, 32 pp., 3 figs., 20 refs. Washington, D.C., 1942.

A detailed account is given of further investigations [*cf. R.A.E.*, A **27** 188], carried out in 1936 and 1937, to determine the effect of a variety of factors on the removal of lead residues from apples grown in Maryland and West Virginia. The following is based on the authors' summary and conclusions. Four varieties of apples were given different spray treatments (5 or 7 cover sprays of lead arsenate, with or without Bordeaux mixture, mineral oil or both) during two seasons, picked at different times and given different washing treatments. Lead determinations were made on washed and unwashed samples, and some samples were stored after the various washing treatments to determine their effect on storage quality. The variation in lead residues among replications was less than reported previously [**25** 434] and was due largely to differences in the size of the apples, each increase in weight of 1 per cent. resulting in an average decrease in residue of about 0·8 per cent. both before and after washing. The residue at harvest and the percentage of residue retained after washing varied in different varieties. Growth and weathering apparently had very little effect on the reduction of residue during the harvest period, and there is evidence that rainfall has little tendency to wash the residue from the apples, particularly during the harvest period. The percentage of the residue removed by washing was reduced by delay in the harvesting of one variety, but not affected in the case of another. The general effect of delay between harvest and washing was to increase the difficulty of residue removal, but it varied with the season, variety, spray treatment, washing treatment, the temperature during the delay period and the length of it. It was greater when the late cover sprays included mineral oil emulsion than when no oil emulsion was used, possibly because of a stimulating effect of oil sprays on wax development during ripening, and less when a wetting agent or detergent that would tend to remove some of the waxy coating was used in the washing solution. A delay of one week at freezing point did not increase the difficulty of residue removal.

The addition of mineral oil emulsion to the second-brood cover sprays of lead arsenate and Bordeaux mixture increased the residue at harvest by nearly 50 per cent., but the percentage of the original residue removed by the washing treatments was greater in samples sprayed with oil, so that with the more effective washing treatments (heated solutions of acid and wetting agent) the residue remaining after washing was as low as that on those not treated with oil or even lower. The omission of Bordeaux mixture (2 : 4 : 100) from the second-brood cover sprays of lead arsenate did not significantly increase the residue at harvest, but did increase the difficulty of removing it, so that a considerably heavier residue remained after washing. Its omission from second-brood sprays of lead arsenate and mineral oil emulsion greatly increased the lead residue at harvest and reduced the percentage removed by washing, so that the residues after washing were much higher with this type of spray treatment than when Bordeaux mixture, with or without oil emulsion, was included.

The results obtained when 60 samples of apples representing different varieties and spray treatments were given various washing treatments confirmed those previously reported [**27** 189]. Heating an acid solution to 100°F. resulted in considerably greater benefit in a flood or flood-brush machine than in a flotation machine, and with the same acid concentration, a flood machine with an exposure of 35 secs. was considerably more effective than a flotation machine with one of 60 secs. With the most effective washing treatment for each type of machine there were no very large or consistent differences in the effectiveness of the different types. In a flotation machine, the addition of 1 per cent. of a wetting agent to the acid solution greatly increased the effectiveness of the wash for all types of spray treatments and for all varieties of apples. It was more effective in heated solutions than in cold ones, and on apples treated with sprays containing oil or Bordeaux mixture than on others. In a flood-type machine, the addition of a wetting agent, at the concentration possible and with an antifoam agent, did not increase the effectiveness of the treatment.

Washing with heated solutions did not increase the amount of spoilage in apples of two varieties during storage and did not affect the firmness of the fruit or appreciably increase the wilting.

EICHMANN (R. D.). **Tartar Emetic for Thrips Control on Greenhouse Carnations.**—*Bull. Wash. agric. Exp. Sta.* no. 417, 35 pp., 9 figs., 26 refs. Pullman, Wash., 1942.

Data on the bionomics of *Thrips tabaci*, Lind., on various plants and *Taeniothrips simplex*, Morison, on gladiolus and on measures for the control of these and other thrips are reviewed from the literature. Both attack glasshouse carnations in eastern Washington, where damage to the blossoms by *Thrips tabaci* is so severe in spring that they are unsaleable unless it is controlled. Its life-cycle in the greenhouses is completed in 16–29 days, the duration decreasing as the season advances from February to May. The egg and nymphal stages last 6–12 and 6–10 days, respectively, and the prepupal and pupal stages together 4–11 days.

The carnations are usually planted in the houses in August and are damaged from the end of September, when flowering is allowed to begin, until November and from March throughout the summer ; damage is slight when the intensity of light, length of day and temperature are at a minimum and severe when they are at a maximum, but active adults and nymphs of both species occur in small numbers on the plants throughout the winter. In autumn, as many as 90 per cent. of the thrips on carnation are *Taeniothrips simplex*, and in spring, when populations are higher and most damage occurs, about 90 per cent. are *Thrips tabaci* ; during summer, when carnations are of little commercial value, the species are equally abundant and the population is highest. Dark-coloured varieties show more damage than light ones, but there is also marked variation in resistance between varieties within a colour, and control is simplified if only the more resistant varieties are grown.

The results of laboratory and greenhouse tests carried out in 1937–41, chiefly against *T. tabaci*, most of which have already been noticed from shorter accounts [*R.A.E.*, A **29** 413 ; **31** 94], showed that sprays of tartar emetic, sugar and water gave the best control. The only material that was effective without the addition of sugar was dinitro-ortho-cyclohexylphenol, which gave complete mortality, probably by contact action, in two days in the laboratory when applied in a spray at the rate of 1 lb. per 100 U.S. gals. water, with or without 1 lb. white sugar, or in a commercial sulphur dust. It was applied to the leaves before the thrips were caged on them, but was not further tested in the greenhouse. Maize syrup (3–4 pints per 100 gals.) or molasses (1–2 pints), can be substituted for sugar in the tartar-emetic sprays if the latter becomes unobtainable.

KNOWLTON (G. F.). **Utah Bird Predators of the Beet Leafhopper.**—*Mimeogr. Ser. Utah agric. Exp. Sta.* no. 282, 2 pp., multigraph, 2 refs. Logan, Utah, 1942.

Migrating insectivorous birds have been shown to cause considerable reduction of the autumn populations of *Eutettix tenellus*, Baker, in its semi-desert breeding areas in Utah [*R.A.E.*, A **23** 180; **24** 67], and an attempt was therefore made to ascertain the extent to which this Jassid is destroyed by birds in agricultural areas during the earlier part of the year. Recognisable remains of *E. tenellus* were found among the stomach-contents of 34 species of birds examined between April and October, inclusive, and maximum numbers of both nymphs and adults were found in September. No nymphs and only a few adults were present in birds taken in April and May, and it is concluded that although birds limit the numbers of *E. tenellus* to some extent throughout the year, they appear to do so chiefly in the autumn.

McGuffin (W. C.). **New Descriptions of Larvae of Forest Insects, V,** *Eupithecia, Hydriomena* **(Lepidoptera, Geometridae).**—*Canad. Ent.* **74** no. 8 pp. 150–153, 7 figs., 2 refs. Guelph, Ont., 1942.

The larvae described in this part of a series on Canadian forest insects [*cf. R.A.E.*, A **30** 586] are those of *Eupithecia gibsonata*, Tayl., which feed on white cedar [*Thuja occidentalis*], and *E. palpata*, Pack., and *Cidaria* (*Hydriomena*) *divisaria*, Wlk., both of which attack spruce [*Picea* spp.], balsam fir [*Abies balsamea*] and larch, and the latter also pines.

Morris (R. F.). **The Use of Frass in the Identification of Forest Insect Damage.**—*Canad. Ent.* **74** no. 9 pp. 164–167, 1 fig., 4 refs. Guelph, Ont., 1942.

The ways in which studies of collections of frass have been used in investigations of populations and feeding activity of forest insects are briefly reviewed, and the possibility is discussed of identifying the group or species to which a larva belongs from the kind of frass it has produced, even when it is itself no longer present on the tree. A key is given in which the size, shape and texture of the frass pellets are used for the specific identification of the last-instar larvae of several sawflies and Lepidoptera found feeding on the needles of spruce in New Brunswick. It has been tested with satisfactory results by a number of persons, but is incomplete for most spruce stands, and its value is thought to lie chiefly in the indication it provides of the characters that can be employed. It is not known whether it can be expanded to include all defoliators of spruce, or whether similar keys can be prepared for other food-plants, but evidence has been obtained indicating that this may be possible for defoliators of pine.

Brown (W. J.). **The American Species of** *Entomoscelis* **and** *Hippuriphila* **(Coleoptera, Chrysomelidae).**—*Canad. Ent.* **74** no. 9 pp. 172–176, 8 figs., 7 refs. Guelph, Ont., 1942.

The author states that comparison of two males of *Entomoscelis adonidis*, Pall., from north-western Persia and an unlabelled female with specimens of the American Cerambycid that has been considered to be this species showed differences in colour and sculpture and in the form of the aedeagus of the males. He accordingly describes the American form as *E. americana*, sp. n. The range of *E. adonidis* is reported to extend from southern France and Germany to Persia and southern Siberia, and there is no evidence that it is continuous with that of *E. americana*. In Canada, the latter appears to be restricted to an area bounded by the coastal range of British Columbia and a line extending from Dawson, Yukon Territory, to south-central Manitoba; in the United States, it has been recorded from Alaska, Washington, Montana, Utah, Colorado and Minnesota. Although it is a pest of cruciferous crops in Canada [*R.A.E.*, A **24** 614; **26** 170], it has attracted little attention in the United States.

[TAL'MAN (P. N.).] **Тальман (П. Н.). The economic Importance of the Transbaikalian Cerambycid in Forests.** [*In Russian.*]—*Lesn. Khoz.* [Forestry] 1940 no. 7 pp. 61–64, 2 figs., 1 ref. Moscow, 1940. [Recd. 1943.]

Outbreaks of *Dendrolimus superans*, Btlr. (*sibiricus*, Tshtv.) have occurred in forests of *Larix gmelini dahurica*, in the Province of Chita (east of Lake Baikal) since 1934–35, and by 1937 the infestation had spread over some 11,500 sq. miles. A survey of the secondary pests of this larch showed that *Xyloclytus altaicus*, Gebl., was the most important. The larva, pupa and adults of this Cerambycid are briefly described. Development lasts two years, and there are two distinct broods, of which the one that gives rise to adults in odd years is not numerous and is of no economic importance, while the one that does so in even years is very injurious. The mass flight occurs from the end of June to the end of August, with a peak during the first three weeks of July, and pairing takes place at once. The total numbers of eggs laid by females in the laboratory averaged 63·6, with a maximum of 120. They are inserted singly or in pairs in cracks in the bark from the base of the trunk to a height of 65 ft., and the larvae hatch in about 15 days. They immediately penetrate under the bark and bore long tunnels that touch the sapwood and are filled with frass. Towards the end of July, infested stems begin to exude resin. The larvae overwinter in their tunnels and continue to develop till about mid-August, when they enter the wood and bore to depths of up to 5 ins. in the direction of the heartwood; they overwinter again and in the spring bore outwards and form pupal chambers close to the bark. Pupation occurs at the beginning of June, the pupal stage lasts 14–17 days, and the newly emerged adults remain in the pupal chambers for 8–9 days.

The losses caused by *X. altaicus* are severe; of over 4,000 trees found infested by insects in 1937 and 1938, 62½ per cent. were damaged by the beetle. Oviposition occurs only on *L. gmelini dahurica*, and usually in weakened, but still living, trees. Under experimental conditions, however, eggs were also laid on pines. Prior to the outbreaks of *D. superans*, the Cerambycid infested trees that had been weakened by forest fires. Towards 1938, however, it had so increased in numbers that females oviposited on completely healthy larches as well. Observations showed that the number of trees killed by it increases with their age. It was estimated in 1938 to have killed two-thirds of all the trees in an area of some 390 sq. miles in the centre of the heavily infested zone.

Since the extent of the area affected precludes the complete clearing of the infested stands and the removal of the felled trees, control should be concentrated on sections that have sustained relatively little damage or adjoin valuable blocks. Trees that exude resin, which is a reliable indication of the presence of the young larvae, and trees severely damaged by fire or weakened by crowding or wind should be felled first. Since the adults are present from the end of June, it was recommended in 1940 that felling should be begun at the end of July and continued until August of the following year. Felled trees should be barked and the branches burnt.

[PORTNUIKH (Yu. P.).] **Портных (Ю. П.). Results of the first experimental Dusting with Pyrethrum of a Forest infested with the Pine Moth.** [*In Russian.*]—*Lesn. Khoz.* [Forestry] 1940 no. 7 pp. 65–69, 3 figs., 1 ref. Moscow, 1940. [Recd. 1943.]

In view of promising results in laboratory tests of preparations of pyrethrum against larvae of the pine moth [*Dendrolimus pini*, L.] in 1938, almost 2½ sq. miles of infested young pines in a district in European Russia were dusted with ground pyrethrum flowers between 24th April and 9th May 1939. The ground flowers are less effective than dusts in which pyrethrum extract is adsorbed on an inert carrier, but the latter are not produced on a large scale in Russia. Large blocks were treated from an aeroplane and smaller ones from a machine mounted on a tractor, which gave as good results over small areas. The effectiveness of the treatment was estimated by counting the larvae that fell from sample trees on to sheets spread beneath them and the living ones in the crown, and calculating the percentage mortality, allowance being made for the fact that some of the fallen larvae recovered within a week.

The results of treatment from the aeroplane, which released the dust over a width of 82 ft., are shown in a table. The highest mortality (80 per cent.) was given by the first application, which was made on the evening of 24th April at the rate of only 4½ lb. per acre. This treatment took place during a light rain that made the dust adhere well to the larvae, their susceptibility was increased by low temperature (5°C. [41°F.]) and the fact that they had not fed after hibernation, and there were no lateral or ascending air-currents in the forest. In subsequent treatments, all of which were carried out in cloudless weather, an increase in the rate to 5·4–6·3 lb. per acre produced a mortality of only 20–30 per cent., though 70 per cent. mortality of larvae in the fifth instar was given by a single application, on 9th May, at the rate of 36 lb. per acre.

Dusting was more effective in the evening than in the morning, owing to the absence of direct sunlight, which decomposes the pyrethrins, and to lower temperatures. The effect of sunlight was shown to be great in a subsidiary test in which the ground flowers exposed to it in a thin layer lost 90 per cent. of their toxicity in 15 minutes and all of it in 30. On the whole, mortality increased with the rate at which the dust was applied, and repeated treatments at low rates proved less effective than a single application of the total amount.

Observations on the effect of wind, in which dusting was carried out in the evening, when there were ascending air-currents, the velocity of the wind was about 5 miles an hour, and the aeroplane flew at a height of 30–50 feet, showed that the dust was carried to distances of about 330 yards. Though only the windward side of one of the plots was dusted, the larvae dropped from the trees on the opposite side, about 220 yards from the line of flight. Some of the dust was carried by ascending air-currents to a height of over 300 ft.

It is concluded that almost complete mortality of the larvae could be obtained in May by applying the dust at the rate of 72–90 lb. per acre. Ground pyrethrum containing 0·4 per cent. pyrethrin I is equivalent in toxicity to a dust of pyrethrin extract adsorbed on talc containing 0·2 per cent. pyrethrin I, and such a dust should not prove too expensive. In less severely infested forests in which the loss of 1–2 years' increment is of no great importance, 50–60 per cent. mortality may be sufficient. In such cases, the rate of application in spring could be reduced to 18–45 lb. per acre. The amount of dust to be used depends on the suitability of the weather and the age of the larvae. Heavier applications are required in spring than in autumn, since the larvae are older, and the most favourable time is in August, when they are in the second instar. In laboratory tests, larvae in the first two instars were killed by a rate of application equivalent to less than two-thirds of that required against those in the second, third and fourth.

Dusting on a small scale with calcium arsenite at the rate of about 10 lb. per acre gave only 20 per cent. mortality of the larvae in 22 days.

[SAVCHENKO (E. N.).] **Савченко (Е. Н.). The Effect of the pH of Emulsions on the Toxicity of Pyrethrum Extracts to Beet Aphids.** [*In Russian.*]—*Nauch. Zap. sakharn. Prom.* **16** no. 1 pp. 138–141, 5 refs. Kiev, 1939. [Recd. 1943.]

To test the correctness of the view that the toxicity of sprays of pyrethrum extract is reduced in alkaline media, so that they should not be used with alkaline soaps [*cf. R.A.E.*, A **18** 486], laboratory experiments were carried out in which neutral alkaline or acid sprays were applied at the rate of 0·3 cc. per sq. cm. to colonies of *Aphis fabae*, Scop., or *Myzus* (*Myzodes*) *persicae*, Sulz., on leaves of beet. The Aphids were then kept for 24 hours at 24°C. [75·2°F.] and 74 per cent. relative humidity. The sprays were applied as soon as they were prepared or were allowed to stand for 6 or 24 hours at 20–25°C. [68–77°F.], but this had no evident effect on their toxicity.

In the experiments with *A. fabae*, the sprays contained 0·0023 per cent. pyrethrin I and their reaction was varied by the addition of phosphate buffers. The percentage mortalities averaged 27, 30, 39, 30 and 29 for pH values of 7·17, 8·04, 9·18, 5·91 and 4·94, respectively. These differences did not, on the whole, exceed the limits of experimental error, and the buffer solutions without pyrethrum extract killed considerable percentages of the Aphids, the alkaline ones being slightly the more toxic.

In the series of experiments with *M. persicae*, the sprays were acidified with hydrochloric acid or rendered alkaline with anhydrous sodium carbonate, and the solutions without pyrethrum killed only very small percentages of the Aphids. Since *M. persicae* is more resistant to pyrethrum than *A. fabae*, the concentration of pyrethrin I was raised to 0·0028 per cent. The percentage mortalities given by this extract in alkaline, slightly acid and strongly acid solutions (pH 8·5, 5·5 and 4·5) averaged 60, 66 and 38, respectively.

It is concluded that pyrethrum extracts are effective in alkaline media, so that soft soap can be used with them. The concentration of soft soap is commonly 0·4 per cent., which raises the pH of the spray to not more than 8·4–8·5. Soft soap facilitates emulsification and reduces the surface tension by about one-half, thus increasing the effectiveness of the sprays. In tests against *M. persicae* of sprays containing from 0·0003 to 0·0036 per cent. pyrethrin I, the addition of soap increased the mortality in every case, the increase being greater for the lower pyrethrin contents.

SPEYER (E. R.), PARR (W. J.) & READ (W. H.). **Animal Pests.**—*27th Rep. exp. Res. Sta. Cheshunt 1941* pp. 53–64. Cheshunt, Herts., 1942.

The work on glasshouse pests in 1941 was concerned largely with those that attack tomato and lettuce, and, except for the second series of experiments against wireworms, it is described by Speyer & Parr. The bait of ale and sugar-cane molasses (3 : 1) with the addition of 1 per cent. sodium fluoride continued to give satisfactory results against the tomato moth, *Polia oleracea*, L. [*cf. R.A.E.*, A **30** 273], but as the supply of cane molasses was restricted, attempts were made to discover a substitute. Liquor of malt, containing 10 per cent. alcohol, and wort did not attract the moths, but malt extract in liquid or powder form was as effective as cane molasses, and a bait containing 4 parts ale, 1 part powdered malt extract and 1 per cent. sodium fluoride, used at the rate of 3 fl. oz. per jar, is recommended. No advantage was gained by substituting cider for ale, and baits containing beet molasses were less effective than those containing cane molasses or malt extract, but were rendered more attractive by the addition of 4 per cent. malt extract. Moths were not attracted to baits containing ale and saccharin or essence of Jargonelle pear [amyl acetate]. Observations indicated that trapping is of little or no value during hot weather, when the doors and vents of the houses are kept open, or after mid-September, and it is suggested that in houses in which lead-arsenate sprays have been applied against the larvae and traps used during the early part of the season, trapping should be discontinued from the beginning of June until mid-August and again after mid-September. A small-scale experiment indicated that a few eggs may be deposited before the moths visit the traps. A fairly even distribution of traps throughout the house, with one at each end, is desirable ; 27 jars per acre is the minimum number likely to prove effective, and 36 is the one recommended.

In continued experiments on the use of selenium to immunise tomato plants from attack by *Tetranychus telarius*, L. [*loc. cit.*], treatment of the seed or seedlings failed to protect the plants after they had been transplanted to pots of untreated soil. The seeds were soaked for 24 hours before sowing in solutions of sodium selenate varying in concentration from 0·015 to 2 per cent., and the seedlings were grown in prepared composts containing 20–70 parts sodium selenate per million, or in soil that was saturated with solutions of sodium selenate so as to give calculated concentrations of 62 and 50 parts per million when they were 2 ins. high. Seedlings in composts containing more than 50 parts sodium selenate per million and in the saturated soil were severely injured, but recovered when transplanted. Plants from seed collected from plants that had been immunised in the previous year were severely attacked. It is pointed out that there is a risk of rendering the fruit unsuitable for consumption and the soil in the houses in which the plants are grown on unfit for the production of a crop by the introduction of selenium into the soil of pot plants in quantities sufficient to prevent attack. Watering the plants with solutions of sodium tellurate, sodium thiosulphate and tartar emetic gave no control. A spray containing 2 lb. tartar emetic and 3 gals. glycerine in 100 gals. water [*cf.* **29** 215] gave good control of the mite but severely injured the foliage of the tomatos ; a reduction of the tartar-emetic content reduced the control but not the injury. In experiments to determine whether the mortality resulting from burning sulphur in glasshouses during winter is due to small quantities of sulphur vapour and not to sulphur dioxide, sulphur volatilised at initial temperatures of 60–66°F. and at rates equivalent to 1–4 oz. per 1,000 cu. ft. space in an almost airtight chamber of 10 cu. ft. capacity was not more toxic to mites hibernating on tomato plants during exposure periods of 18–24 hours than sulphur dioxide obtained by burning the same amounts of sulphur ; all treatments gave 50–80 per cent. mortality. Complete mortality was given by the sulphur dioxide generated by burning an amount of sulphur equivalent to 12 oz. per 1,000 cu. ft. space, but there was some survival in a similar experiment in which the rate was increased to 1 lb. sulphur burnt at the rate of 2½ lb. per 1,000 cu. ft. in a glasshouse that was not completely air-tight destroyed only 86 per cent. of the mites hibernating on tomato plants and a much smaller percentage of others in perforated boxes distributed throughout the house.

The commonest Aphids on lettuce and tomato under glass were found to be *Macrosiphum solani*, Kalt., and *Myzus ornatus*, Laing ; *M. persicae*, Sulz., occurs on lettuce and carnations and *M.* (*Nasonovia*) *ribicola*, Kalt., on lettuce. The source of infestation of young tomato plants that were attacked by *M. circumflexus*, Buckt., was found to be *Arum* and *Primula*. *Macrosiphum solanifolii*, Ashm., appears to be a minor pest on both tomato and lettuce, but very severe infestations occurred on the former in September. Feeding by Aphids results in the appearance of orange spots on the lower leaves of tomato, and in one instance *M. solani* caused large dark spots to appear on the swelling fruit.

In experiments on the control of wireworms attacking lettuce, mercurous chloride in a 4 per cent. dust or as an undiluted powder, a mixture of castor-meal and Paris green (28 : 1), kaolin containing 1 per cent. α-naphthylamine or allyl isothiocyanate, and powdered derris and *Lonchocarpus*, applied to the dibbed holes before planting out, all failed to give protection against larvae of *Agriotes*. When a mixture of kaolin and powdered naphthalene (4 : 1), lime ground with allyl isothiocyanate (19 : 1), or powdered derris or *Lonchocarpus* was mixed with the soil, and potassium chloride or ammonium carbonate distributed on the soil and watered in, none retained its toxicity for long enough to warrant its use for control. Observations on the habits of wireworms and on trapping made in glasshouses in Northumberland showed that the larvae may be 2 ft. deep in the soil in winter, even in heavy clay, the depth being determined by moisture requirements rather than by temperature. If populations are relatively small, winter lettuce under glass can be protected to a considerable extent by burying slices of carrot or split vegetable stalks as baits at a depth of 2–4 ins. between the rows. Thickly-sown drills of wheat, 2–3 ins. wide and not more than 4 ft. apart, are still more attractive, and, as the larvae appear to fast for long intervals after feeding, it is probably not necessary to lift the wheat until it is at least 8 ins. high. If populations are large, baits should be used to catch the wireworms before planting out lettuce and tomato, and the soil should be kept moist and a minimum night temperature of 45°F. maintained throughout the trapping period. Larvae of *Athous* were attracted to vegetable baits and germinating wheat, but did not appear to attack lettuce or tomato; they were destroyed by larvae of *Thereva*, which, however, were not observed to feed on larvae of *Agriotes*.

Read describes experiments on the value against wireworms of drenching the soil in tomato houses with dilute emulsions of carbon bisulphide [*cf.* **29** 145]. A stock emulsion containing 50 per cent. carbon bisulphide was used, and the tests were made on moist soil containing 200 larvae per square yard; the temperature at a depth of 6 ins. varied between 57 and 61°F. Plants set out on 27th February and 15th March in soil treated on 22nd February and 14th March, respectively, with a drench containing 1 fl. oz. emulsion per gal. at the rate of 10 gals. per square yard, and on 15th March in soil treated the day before at the same rate but at half the concentration, remained free from wireworm injury, and no wireworms were found at carrot baits among the plants. In the control plot, nearly all the plants were destroyed or severely injured by wireworms, many of which were trapped at carrot baits. Plants in plots that were treated at the rate of 10 gals. per square yard with a 0·8 per cent. solution of formaldehyde or a 0·4 per cent. solution with the addition of ½ fl. oz. carbon bisulphide per gallon remained free from injury, but the results were inconclusive, since the number of dead and living larvae recovered was considerably smaller than the number known to be present at the beginning of the experiment; the absence of damage on plants in adjoining houses suggests that the larvae were not driven from the treated plots.

In a commercial nursery in Hertfordshire, larvae of *Hepialus lupulinus*, L., ringed the stems of chrysanthemums at ground level, causing the plants to wilt and subsequently die. In previous years, plants had been killed in spring shortly after being re-potted in soil from grassland that was heavily infested with these larvae, and again in autumn after the final potting. Larvae in soil containing naphthalene (1 : 1,200) died within four days, and the incorporation of naphthalene with potting soil at the rate of 1½ oz. per cwt. was therefore recommended, but it appears that control was obtained by sprinkling small quantities of naphthalene over the soil in the pots from time to time. Larvae of *H. lupulinus* were numerous below turf in the north of England and were not affected by exposure to −3°F. in January. In Hertfordshire, they pupated towards the end of May and the adults emerged in June. *Thrips fuscipennis*, Hal., severely damaged the fruit and foliage of peach in a nursery in Sussex.

Bewley (W. F.). **Tomatoes: Cultivation, Diseases and Pests.**—*Bull. Minist. Agric.* no. 77 (revd.) ii+65 pp., 4 pls., 1 fig., 7 refs. London, H.M.S.O., 1942. Price 2*s.* 0*d.*

In this edition [*cf. R.A.E.*, A **22** 630; **30** 504], the section on pests of tomato in glasshouses in Britain (pp. 43–54) has been revised by E. R. Speyer; additional pests are included, more details are given of the life-histories of the others and the damage they cause, and the control recommendations are brought up to date.

The young larvae of *Polia oleracea* L., skeletonise the lower rough leaves of plants in the propagating house and the older ones feed on the stems, fruit and leaves after planting out. Control measures comprise spraying against the larvae, trapping the moths in glass jars, with mouths at least 2 ins. wide, containing a sweetened bait [*cf.* preceding abstract], which should be renewed every three weeks, and removing fallen fruit and weeds. A spray of lead arsenate [*cf.* **22** 630] should be applied to potted plants in the propagating house and again a week after planting out and two weeks before the fruit begins to swell on the bottom trusses, and a proprietary rotenone spray should be used if larvae are present on the plants after picking of the fruit has begun. The best fumigants for the control of *Trialeurodes vaporariorum*, Westw., which is very widely distributed, are proprietary powders that give off hydrocyanic acid gas comparatively slowly or tetrachlorethane. The powders should be sprinkled along the slightly moistened paths at the rate recommended (usually $\frac{1}{4}$—$\frac{1}{3}$ oz. per 1,000 cu. ft. space) shortly after sunset on a still night, when the plants are dry at the roots ; a second treatment should be given two weeks later in hot weather or three weeks later in cold. Tetrachlorethane should be poured on the paths at the rate of 10 fl. oz. per 1,000 cu. ft., or at 5 fl. oz. if the plants are young or the parasite, *Encarsia formosa*, Gah., has been introduced.

To prevent infestation by *Tetranychus telarius*, L., the staging, seed-boxes and pots for the propagating house should be kept clean and stored away from weeds, in a clean dry shed, or they may harbour overwintering mites ; bamboo canes should be immersed in boiling water for 30 minutes if their use cannot be avoided, and new fillis for stringing the plants should be used every season. Infested plants should be sprayed once a fortnight with a proprietary derris extract, at the highest concentration recommended by the manufacturer, until the end of May, and then with an emulsion of refined petroleum at the rate recommended (usually 1 part emulsion in 100–150 parts water). Three applications of oil should be made at intervals of 10 days, after which three weeks should elapse before further treatments are applied. Owing to the danger of causing oedema of the foliage, the plants should not be watered for at least two days before or after application, and adequate ventilation should be ensured, accompanied by thinning of the foliage before spraying when the plants are 4 ft. high or more. If the mites persist on the plants or an infestation begins late in the growing season, spraying should be continued until the crop is harvested and the plants should then be removed from the houses immediately and burnt or stacked at some distance. Treatment of the house with emulsified cresylic acid, fumigation with naphthalene and the burning of sulphur in autumn or winter are no longer considered to give adequate protection.

Severe infestations of Aphids may develop, particularly if lettuce previously grown in the houses has been attacked [*cf.* preceding abstract] ; they usually occur early in the growing season, but have been recorded in late summer. They can be controlled by fumigating with tobacco shreds at rates, varying with the product, of from 1 to 3 oz. per 1,000 cu. ft. ; the shreds should be placed in heaps of not more than 3 oz. along the paths, set alight towards evening and allowed to smoulder during the night. A single fumigation is usually sufficient. If only a few plants are infested, the underside of the foliage should be dusted lightly with pyrethrum powder on a dull day. In nurseries where other plants liable to spotted wilt are grown, *Thrips tabaci*, Lind., which transmits the virus, should be prevented from feeding on the young plants in the propagating house. Pure commercial white-flake naphthalene should be broadcast over the soil at the rate of 2 oz. per sq. yd. and dug in to a depth of a few inches immediately before the staging is erected. The plants should be kept well watered at the roots, and if feeding marks are found on them should be dusted lightly with pyrethrum powder in dull weather at weekly intervals. *Erythroneura pallidifrons*, Edw., which appears to breed only on very young plants and is uncommon, except in nurseries of mixed plants, is repelled by very small quantities of pure white-flake naphthalene scattered on or close to the young plants. *Phytomyza solani*, Macq., which is usually controlled by parasites, but has increased very considerably in the home counties during the past five years, is of minor importance. A spray of 4 fl. oz. nicotine sulphate and ½ oz. saponin in 12 gals. water, applied lightly to the upper surface of the leaves every 2–3 weeks, prevents oviposition.

If the soil is heavily infested with wireworms, tomatos will almost certainly be destroyed soon after they are planted out ; such loss is usually sustained in glasshouses of 2–4 years standing, but occurs annually in others immediately surrounded by heavily infested land. Drills of wheat, sown a few days before the crop is planted out, attract the wireworms during the period in which the tomato plants are most susceptible to injury [*cf.* preceding abstract] ; chemical treatment of the soil cannot be relied on for control. *Scutigerella immaculata*, Newp., sometimes causes severe stunting of young plants, the foliage of which assumes a bluish colour, probably by feeding on the functional root-hairs, and the fungus *Thielavia* often occurs on plants showing these symptoms. *Scutigerella* can be controlled by steam sterilisation of the soil or the application of a 1 per cent. emulsion of carbon bisulphide when it is near the surface [*cf.* **23** 562, etc.]. More liberal applications of stable manure and mixed fertilisers to encourage robust growth should assist in reducing the damage. The woodlice, *Armadillidium speyeri*, Jackson, and *A. vulgare*, Latr., which pass through at least two generations in a season, may destroy large numbers of seedlings by biting through the stems and devouring the upper portion of the plant ; they can be controlled by broadcasting a poison bait containing 1 lb. Paris green in 28 lb. dry bran, 56 lb. dried blood or 20 lb. each of dried blood and castor meal at the rate of about ¼ oz. per sq. yd.

CAMERON (A. E.). **Insect and other Pests of 1941.**—*Trans. Highl. agric. Soc. Scot.* 1942 repr. 29 pp., 44 figs., 3 refs. Edinburgh, 1942.

In view of the great importance of pests of stored products, particularly cereals and other foodstuffs, under wartime conditions, the author discusses the ways in which the produce becomes infested and methods of protecting it and gives a list of 26 insects and 2 mites that have recently been recorded in Scotland, with the products they infested, and brief notes on their bionomics and the damage they cause. He points out the importance of cleanliness and low temperature in preventing the development of insects and discusses the value of fumigation, treatment with atomised contact sprays, screening grain in the early stages of an infestation and the use of inert dusts for controlling them.

Italy. San José Scale Infestation.—*Int. Bull. Plant Prot.* **16** no. 7–8 p. 101M Rome, 1942.

Following the discovery of slight infestations of *Aspidiotus perniciosus*, Comst., in two orchards in the Provinces of Verona and Padua during 1940, the control of scale insects on fruit trees by means of winter sprays of 7 per cent. mineral oil emulsion and the fumigation of all nursery stock with hydrocyanic acid gas were made compulsory by decrees of December 1940 and February 1941. In the spring of 1941, however, traces of infestation were present in these and three other orchards in the same two Provinces and a small focus in the Province of Lucca. The compulsory measures were made to cover all the Provinces of central and northern Italy, but sporadic infestation persisted in Verona, Padua and Lucca.

WAHLEN (F. T.). **Switzerland. Colorado Beetle Situation in 1941.**—*Int. Bull. Plant Prot.* **16** no. 7–8 pp. 102M–106M, 1 map. Rome, 1942.

In 1941, overwintered adults of *Leptinotarsa decemlineata*, Say, began to emerge at the end of a warm April, but May was cold and rainy, and they did not appear in numbers until mid-June, when oviposition was first observed. High temperatures, reaching 30°C. [86°F.] or more in some districts, prevailed after this date, and the adults exhibited a strong tendency to fly in swarms ; large numbers entered western Switzerland from France, aided by a west wind, and spread throughout the country [*cf. R.A.E.*, A **28** 586]. The maximum number of foci of larvae was reported during the second week of July. Warm, dry weather during this month provided optimum conditions for development, and adults of the summer generation began to oviposit in the first week of August.

Despite the heavy infestation, damage to potato was not severe. Spraying gave effective control, cool, damp weather in August and September destroyed many eggs and young larvae, and at high altitudes there was early frost. Development was retarded by the cool nights, and in the mountain cantons there was only one generation during the year. A total of 23,969 foci was reported from German Switzerland, and infestation in French Switzerland was too widespread for foci to be distinguished, except in Fribourg, where there were 2,697, and Valais, where there were 179. The distribution of the foci throughout the country is shown on a map, and the number of communes infested and foci reported in each year from 1937 to 1941, inclusive, are given for French Switzerland, German Switzerland and the whole country. Infestation was recorded in three additional cantons in 1941 [*cf.* **30** 545], Graubünden and Ticino being the only ones from which no focus has been recorded. The number of foci in Schaffhausen, however, was greatly reduced by the careful application of sprays, and this is considered to be indicative of the possibilities of control.

It is stated that a new organic non-arsenical preparation has been produced by a chemical works at Basle that is harmless to mammals and birds and very effective against *L. decemlineata* and other insect pests. It acts as either a contact or a stomach poison, its toxicity is not affected by exposure to light and air, and it has a high adhesive capacity that renders it very promising as a dust.

Germany. The Colorado Beetle (*Leptinotarsa decemlineata*) **in 1941.**—*Int. Bull. Plant Prot.* **16** no. 9 pp. 117M–118M. Rome, 1942.

Leptinotarsa decemlineata, Say, was reported on potato from 164 municipal and rural districts in 1941, as compared with 174 in 1940. The appearance of the overwintered beetles was delayed by cool weather in April and early May, and the first adult attacking plants and the first egg-masses were observed on 14th May. Larvae, which were most abundant between mid-June and mid-July, were first reported on 1st June, pupae on 23rd June, and first-generation adults on 1st July. Second-generation larvae were present from mid-July, but this generation did not appear to attain its full development. First-generation adults began to enter the soil early in August ; very few were left in the fields by the first fortnight in September, except in certain relatively warm districts, where they persisted until the beginning of October.

The beetle was abundant in Baden, Westmark and Hesse, but fewer foci than was expected were reported from the region of North Moselle. Severe infestation also occurred in Alsace, Lorraine, the district of Malmédy, and some parts of Luxemburg, but, as a result of effective spraying operations and other measures, no damage was caused. Control measures carried out in the eastern departments of occupied France, where infestation was also heavy, prevented an eastward extension of the infested area into Germany.

Liro (J. I.). **Finland.** *Eriophyes tulipae,* **as an Onion Parasite.**—*Int. Bull. Plant Prot.* **16** no. 9 p. 118M. Rome, 1942.

In May 1942, the leaves of onion bulbs that had sprouted during storage at Lepaa, Finland, were found to be heavily infested with a mite determined as

Eriophyes tulipae, Keifer, which was originally described from tulip bulbs said to have originated from Holland [*R.A.E.*, A **26** 650]. The origin of the infested onions was unknown, but the mite was soon afterwards found to occur on onions at Helsinki, and all the infested material there originated from a plant breeder in southern Finland who had raised his bulbs from a stock obtained from Holland some years previously. The mite causes severe damage to the onions, which are soon completely destroyed by mould, and the losses at Lepaa were estimated at approximately 30 per cent.

MARTELLI (G. M.). **Libya. Experiments for controlling the Olive Fly in Tripolitania with the De Luca Method.**—*Int. Bull. Plant Prot.* **16** no. 9 pp. 119M–122M. Rome, 1942.

On 18th September 1938, five olive trees, each about 20 ft. high, bearing a heavy crop of unripe fruits of which about 12·6 per cent. were infested by *Dacus oleae*, Gmel., were thoroughly sprayed with a mixture consisting of 25 lb. iron sulphate, 4 gals. lime-sulphur (35° Baumé), 5 lb. solid creoline and approximately 5 gals. milk of lime (sufficient to give a slightly alkaline reaction) in 100 gals. water at the rate of 15–20 gals. per tree. The spray left a deposit on the plants that was not washed off by fairly heavy rain, but was easily removed, especially from the top of the crown, by the friction caused by even slight wind. Three of the trees were therefore sprayed again, at the rate of 6½–10 gals. per tree, on 5th October, the percentage infestation before the second application being 14·3. On 20th October, the percentages of olives infested on trees that received one and two applications and on the controls were 17, 14·3 and 48·9, respectively, and the corresponding figures at the beginning of December, when harvesting was complete, were 32·9, 16·6 and 100. The fruits on the control trees had become blackish by 20th October, but most of those on the treated trees remained green. At harvest, the fruits were left on a branch of one of the trees that was sprayed twice, and most of them were still free from infestation in the middle of January, after which they were eaten by birds, whereas all those on a similar branch of an untreated tree had fallen. The treated fruits yielded more oil than the others and it was of better quality.

In 1939, the spray was tested on table olives of several varieties, and the contents of iron sulphate and lime-sulphur were slightly reduced. Twelve trees were sprayed on 4th June, when oviposition punctures of *D. oleae* were first apparent on the fruits, and by 10th June infestation on control plants reached 90 per cent., the treated trees being free from infestation. A second application was made on 20th June, and this gave protection until harvest at the beginning of September. At that time, the percentage infestation on some of the control plants was 100, whereas on treated trees of the same varieties it did not exceed 8. The treatment slightly retarded the ripening of the fruit and it was necessary to delay harvesting for some twelve days. Treated olives did not differ from controls in appearance or flavour after storage for over a year. In both 1938 amd 1939, the only effect of the treatment on the trees was to cause a slight increase in the fall of old leaves, though the odour of sulphur dioxide persisted until the autumn rains washed away the deposit.

In 1940 and 1941, small-scale tests were made of sprays containing soap, soap and powdered clay, lime-sulphur, solid creoline or fuller's earth, all with the addition of milk of lime, but although some appeared to be promising, the results were inconclusive.

BLETON (C. A.) & FIEUZET (L.). **Notes sur la biologie du bupreste noir des arbres fruitiers au Maroc** (*Capnodis tenebrionis*, **L.**).—*Bull. Soc. Hist. nat. Afr. N.* **33** no. 1–4 pp. 34–42, 1 pl., 22 refs. Algiers, 1942.

The Buprestid, *Capnodis tenebrionis*, L., is a serious and widespread pest of stone-fruit trees in all parts of Morocco, except on the Atlantic coast, and has caused serious injury to apricots in the neighbourhood of Fez, Sefrou and Beni-Mellai. Its local distribution is reviewed, and it is stated that an earlier record of *C. tenebricosa*, Ol., on stone-fruits in Morocco [*R.A.E.*, A **8** 121] refers to it. Larvae of *C. tenebricosa* are common in the roots of a dock (*Rumex pulcher*) in the Fez district. Knowledge of the life-history of *C. tenebrionis* is incomplete. Adult emergence begins in May, reaches a maximum in late June and early July, and ends in September. Adults are present throughout the year in Morocco [*cf.* **25** 67]. Pairing begins in July, and oviposition in the second half of the month, but adults that emerge in autumn overwinter under fallen leaves, stones or hedges and oviposit in the following spring. The oviposition period lasts about 30 days, and females deposit 60–100 eggs. The larvae hatch in about a week and bore beneath the bark in the region of the root-collar, injuring the cambium and cutting off the flow of sap. Observations showed that the larval stage lasts on an average for 22–24 months, but under certain conditions it is apparently completed in 13–14 months. Peach trees infested in July-August 1938 gave rise to adults in May 1940, and examination in November 1941 of the roots of plum trees infested in the summer of 1940 showed that the larvae present were all nearly full-fed and ready to pupate. The pupal stage lasts 3–4 weeks, and is passed in a chamber just below the bark. The adults feed on the buds, petioles and peduncles of stone- and pip-fruits, grape vine, rose and other plants, but cause little injury. Larval infestation of stone-fruits, however, causes yellowing and premature dropping of the foliage, exudations of resin, stunted growth and often death, and renders the trees susceptible to infestation by secondary pests and pathogenic organisms. Observations in the district of Fez showed that the food-plants in order of preference were *Prunus japonica*, plum, apricot, cherry, peach and almond [*cf.* **22** 714]. Larvae have been found in wild cherry (*P. avium*) and sloe (*P. spinosa*), as well as *P. padus* and *P. mahaleb*, which are both used as stocks. Loss is heaviest among young trees in nurseries and up to 3–4 years old.

Petrol as a Grain Fumigant.—*E. Afr. agric. J.* **8** no. 1 p. 20. Nairobi, 1942.

Quotations are given from letters from E. F. Peck, in the Somaliland Protectorate, and W. V. Harris, in Tanganyika Territory, describing tests of the value of petrol as a grain fumigant. Peck learned of the method from a native farmer. In his test, two petrol tins, each containing 4 gals. sorghum heavily infested with weevils, were covered with tarpaulin after 10 cc. petrol had been poured over the grain in one of them ; infestation was still severe in the untreated grain 48 hours later, whereas that treated with petrol contained several thousand dead weevils, but only two living ones. Weevils from the fumigated tin were placed in a warm, airy place for 12 hours, but none of the 200 so treated revived. The flavour of the cooked grain was not impaired.

Harris states that 1 fl. oz. petrol was added to a seed-bin of 2 cu. ft. capacity filled with infested maize, this rate being equivalent to that used by Peck ; since the lid did not fit closely, brown paper was tied over it. After 48 hours it was found that the weevils had congregated at the bottom of the bin and most were alive. In a further test, 4 fl. oz. petrol was added to maize heavily infested with *Calandra* and *Tribolium* that filled an air-tight box of 4 cu. ft. capacity ; examination after 48 hours showed that mortality of *Tribolium* was complete and that of *Calandra* almost so, only 2 of several hundred being found alive. A similar treatment of beans heavily infested with *Bruchus* and mill-sweepings containing a variety of insect pests of stored products killed all the insects except larvae of the cadelle beetle [*Tenebroides mauritanicus*, L.]. The treatment did not impair the germination of either beans or maize. A dosage of 1 pint petrol per 25 cu. ft. is suggested for use in well-sealed containers in Tanganyika ; a disadvantage to the use of this material is that owing to the lightness of the vapour a much tighter container is required than for carbon bisulphide.

Insect Pests.—*Agric. Gaz. N.S.W.* **53** pts. 7–8 pp. 327–330, 348, 374–379, 11 figs. Sydney, 1942.

The first of these parts of a series on insect pests in New South Wales [*cf. R.A.E.*, A **31** 137] includes notes on cultural measures for protecting growing potato tubers from larvae and ovipositing adults of *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell. [*cf.* **27** 389], which usually causes considerable loss in coastal potato crops in October–December. After lifting, the tubers should be stored in moth-proof containers or buildings and, if they become infested, they should be dusted with a mixture of derris powder and kaolin (1 : 4) or fumigated with carbon bisulphide [*cf.* **25** 634]. The larvae and adults of *Bruchus obtectus*, Say, which attack beans in the field or in storage, can be controlled in stored beans by fumigating with carbon bisulphide at the rate of 5 lb. per 1,000 cu. ft. space for 24 hours. Flaked naphthalene, mixed thoroughly with the beans at the rate of 2–3 oz. per bushel (60 lb.) prevents heavy infestation but may affect the germination of beans used for seed. Recent experiments have shown that certain dusts, particularly copper oxychloride or kaolin at 1 lb. per bushel, completely protect beans from infestation provided that they are coated with a thin layer of the dust, which prevents the larvae from eating their way in. Uninfested seed should be stored in stout muslin bags or tins, which the Bruchid cannot enter.

The second part comprises short accounts of the bionomics and control of the more important pests of tomato, which include *Heliothis armigera*, Hb. [*cf.* **30** 397], cutworms, *Listroderes obliquus*, Gylh. [*cf.* **31** 137], *Macrosiphum solanifolii*, Ashm. [*cf.* **30** 100], thrips, *Nezara viridula*, L., *Trialeurodes vaporariorum*, Westw., the tomato mite [*Phyllocoptes lycopersici*, Massee], and in some seasons and districts *Nysius vinitor*, Bergr. [*cf.* **24** 212], Jassids and *Gnorimoschema plaesiosema*, Turner.

HAWKINS (C. N.). **The Insects of Norfolk Island, including a preliminary Report on a recent Collection.**—*Ann. Mag. nat. Hist.* (11) **9** no. 60 pp. 865–902, 38 refs. London, 1942.

In this paper, the author presents available information on the insects known to occur in Norfolk Island, obtained chiefly from a recent collection, but also from scattered sources, including notes on the food-plants, life-histories and distribution of some of them, and gives lists of those that are known to be of economic importance in other parts of the world or are allied to economic species, with records of the crops, products or injurious insects they attack.

PAPERS NOTICED BY TITLE ONLY.

ONISHCHENKO (E. G.). **Die Verbesserung der Backfähigkeit des Mehles aus durch *Eurygaster integriceps* befallenem Korn mittels der thermischen Behandlung des Mehles oder des Kornes.** [The Improvement of the Baking Properties of Flour from Grain attacked by *E. integriceps*, Put., by Heating the Flour or Grain.]—*C. R. Acad. Sci. URSS* (N.S.) **27** no. 8 pp. 809–811, 4 figs. Moscow, 1940. [Recd. 1943.]

GOMES (J. G.). **Uma nova espécie do gênero *Marietta* Motsch. (Chalcidoidea Aphelinidea).** [*M. costa-limai*, sp. n., from *Chrysomphalus ficus*, Ashm. (*adonidum*, auct.) in Brazil.]—*Rodriguesia* **6** no. 15 pp. 53–56, 2 pls., 7 refs. Rio de Janeiro, 1942. [Extract from previous paper: *R.A.E.*, A **31** 118.]

LINSLEY (E. G.). **A new Species of *Callidium*** [*sempervirens*, sp. n.] **from the Coast Redwood, *Sequoia sempervirens*** [in California] **(Coleoptera, Cerambycidae).**—*Pan-Pacif. Ent.* **18** no. 4 p. 192. San Francisco, Calif., 1942.

THOMPSON (M. A.). **Cumulative Index to Service and Regulatory Announcements (Bureau of Entomology and Plant Quarantine) nos. 1 to 149 inclusive, 1940–41.**—89 pp. Washington, D.C., U. S. Dep. Agric., 1942.

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